Global and complementary actions for electronics extended producer responsibility

A thought paper for International E-waste Day 2022

Copyright and publication information

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Abbreviations

BAC: Benelux Afro Center
CENELEC: European Committee for Electrotechnical Standardization
CFSK: Computers for Schools Kenya
CIS: Commonwealth of Independent States
COP: Conference of the Parties
CSR: Corporate Social Responsibility
DPG: Deutsche Pfandsystem GmbH
DPP: Digital Product Passport
DRS: Deposit Return Scheme
EACO: East African Communications Organisation
ECoN: E-waste compensation as an international financing mechanism in Nigeria
EEE: Electrical and Electronic Equipment
EPA: European Network of the Heads of Environment Protection Agencies
EPR: Extended Producer Responsibility
EPREL: European Product Registry for Energy Labelling
EU: European Union
GESP: Global E-waste Statistics Partnership
GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit
GLICE: Great Lakes Initiatives for Communities Empowerment
ICT: Information and Communications Technology
IEC: International Electrotechnical Commission
IPR: Individual Producer Responsibility
OECD: Organisation for Economic Co-operation and Development
PACE: Basel Convention Partnership for Action on Computing Equipment
PIC: Prior Informed Consent
PPE: Personal Protective Equipment
PRO: Producer Responsibility Organization
RECS: Regional Economic Communities
RURA: Rwanda Utilities Regulatory Authority
SDDA: Sustainable Digital Development Alliance for Africa
SOP: Standard Operating Procedure
ULAB: Used Lead-Acid Batteries
UNITAR: United Nations Institute for Training and Research
UPR: Universal Producer Responsibility
WEEE: Waste Electrical and Electronic Equipment

International E–Waste Day
Powered by the WEEE Forum

About International E-Waste Day:

International E-Waste Day (IEWD, #ewasteday) takes place on 14 October every year and was introduced in 2018 by the WEEE Forum with the support of its members. It serves to raise the public profile of WEEE recycling and encourage consumers to return their end-of-life gear for responsible recycling or to consider reuse or repair. Each year numerous organizations join the celebrations by organizing awareness raising activities globally. In 2019, ITU collaborated with the WEEE Forum on IEWD to help promote the importance of responsible recycling of WEEE. Strong partnerships are key to achieving this. The WEEE Forum and ITU have continued to partner for IEWD 2020 and 2021, by preparing respectively a e thought paper on Internet waste[1] and on digitalization of e-waste management[2] (in partnership with GSMA and Sofies). In addition, members of the WEEE Forum selected small e-waste as theme of the IEWD 2022, under the slogan 'Recycle it all, no matter how small!' to focus public attention on the small electrical devices that are no longer used but keep in drawers and cupboards or often toss in the general waste bin.

For more information, visit **www.internationalewasteday.com.**

About the StEP initiative:

The Solving the E-waste Problem (StEP) Initiative is an independent, multi-stakeholder platform for developing strategies and locally adapted and integrated solutions addressing opportunities and threats of e-waste management in an increasingly digitized world. StEP brings together stakeholders along the entire life cycle of electrical and electronic equipment. StEP envisions being an agent and steward of change, leading global thinking, knowledge, awareness and innovation in the management and development of environmentally, economically and ethically-sound e-waste resource recovery, re-use and prevention strategies.

For more information, visit **www.step-initiative.org**.

About ITU:

The International Telecommunication Union (ITU) is the specialized United Nations agency for information and communication technologies (ICTs), driving innovation in ICTs together with 193 Member States and a membership of over 900 companies, universities, and international and regional organizations. Established over 150 years ago in 1865, ITU is the intergovernmental body responsible for coordinating the shared global use of the radio spectrum, promoting international cooperation in assigning satellite orbits, improving communication infrastructure in the developing world, and establishing the worldwide standards that foster seamless interconnection of a vast range of communications systems. From broadband networks to cutting edge wireless technologies, aeronautical and maritime navigation, radio astronomy, oceanographic and satellite-based earth monitoring as well as converging fixed mobile phone, Internet and broadcasting technologies, ITU is committed to connecting the world.

For more information, visit **www.itu.int.**

About the WEEE Forum:

The WEEE Forum a.i.s.b.l. is an international association representing forty-six producer responsibility organizations across the globe. Together with its members, it is at the forefront of turning the extended producer responsibility principle into an effective electronic waste management policy approach through combined knowledge of the technical, business and operational aspects of the collection, logistics, de-pollution, processing, preparing for reuse and reporting of e-waste. Its mission is to be the world's foremost e-waste competence centre, excelling in the implementation of the circularity principle.

For more information visit, **www.weee-forum.org**.

Introduction

Consumption rates of electrical and electronic equipment (EEE) have grown drastically in the last few decades causing an inevitable increase in the amount of e-waste generated. According to one report, the global consumer electronics market will reach USD 1.787 billion by 2024.[3] On average, the total weight of global EEE consumption excluding photovoltaic panels increases by 2.5 million metric tonnes every year.[4] Those new trends in the consumption of EEE are a direct consequence of widespread economic development. In a society driven by innovation, modernization, and urbanization, EEE has become indispensable. Moreover, products such as smartphones and televisions are in high demand as symbols of an enhanced lifestyle, becoming more accessible worldwide. The growth of the global middle class influences EEE consumption rates. According to the World Bank,[5] middle income countries are now home to 75 per cent of the world's population. Estimates had projected this social class to account for around 1.38 billion people by 2020.[6] Within the next 10 years, the number of households in (and above) the upper-middle income category in China is expected to grow by almost 70 per cent[7] meaning the associated increase in annual consumption in China alone will undoubtedly have a significant impact on the amount of e-waste generated.

Increasing e-waste collection is important to help prepare for potential material shortages and supply chain disruption, to improve environmental and human health conditions, to create jobs, reduce the digital divide and ultimately shift to a circular economy. E-waste is currently one of the fastest growing waste streams.[8] E-waste collection is increasingly being carried out in response to regulation whereby the extended producer responsibility (EPR) concept is the driver. ITU defines EPR as a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibility of the manufacturers of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product.[9] Put simply, it means that manufacturers are responsible for the environmental impact of their products.

The aim of this thought paper is to present complementary solutions and concepts to propel e-waste collection rates in line with EPR-based regulation, whilst also delving into the perceived need for an international regime around EPR to assist with harmonization efforts. New and complementary solutions and concepts are urgently needed to turn the tide on the side of e-waste collection and to move towards a circular economy.

Informal e-waste collection has been carried out for a very long time, in unknown volumes globally, but widely reported as expanding in countries such as India,[10] Ghana[11] and Nigeria.[12] However, complementary solutions are growing, led by stakeholders from the full length of the electronics value chain. In most instances, these solutions offer the possibility for integration with existing EPR-based approaches to e-waste management, and where there is no existing policy and regulatory framework, they provide the foundations to new approaches. There exists a patchwork of EPR definitions and laws in many countries around the world with wide variations in obligations for producers of electrical and electronic equipment (EEE). This paper presents potential elements of an international regime, including baseline international standards, guidance and harmonized definitions, tracing modalities, and databases and twinning initiatives. It also outlines the challenges facing EPR globally.

The first part of this paper focuses on the concept and practice of 'collection'. It does therefore not single out other activities within the management of e-waste such as repair, recycling, reuse or refurbishment etc. This allows the thought paper to present specific solutions to one of the main challenges of e-waste management, how to get used and end-of-life equipment to registered recycling facilities.

The second part of the paper focuses on the global implementation of EPR-based e-waste regulation and the perceived need for an international regime to coordinate this.

An online survey was sent to over 30 different stakeholders globally to understand their views concerning complementary actions to support EPR and the application of EPR globally for e-waste. Survey recipients were then consulted bilaterally through a series of interviews.

Complementary actions

Potentially high-impact and complementary actions are needed to support long-term policy decisions, such as EPR-based regulation in its ambition to improve global collection rates. These actions could include innovative tools, solutions and concepts applied alongside fledgling or mature EPR-based regulation to boost e-waste collection rates.

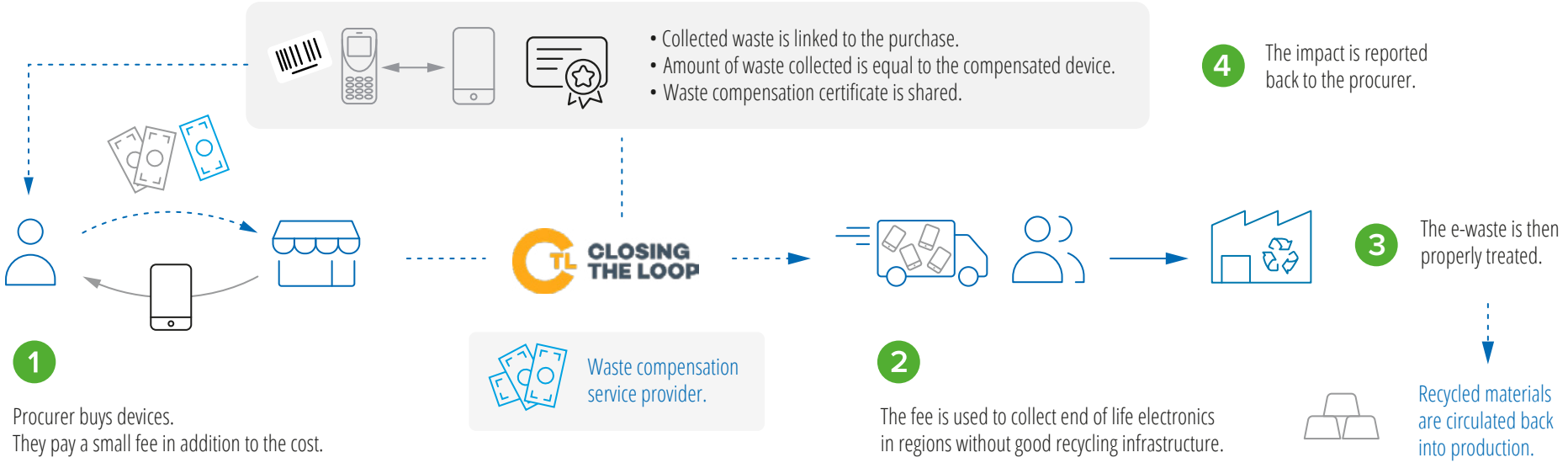
In the European Union (EU) alone, 12 million metric tonnes (Mt) of e-waste are generated each year. If raw materials were extracted from this waste stream, the economic value would equate to USD 12.9 billion[13]. Six of the nine planetary boundaries[14] have already been transgressed. Crossing planetary boundaries entails the disruption and increased risks of irreversibility of earth systems. The planetary boundary for green water and environmental pollutants (novel entities) are the most recent boundaries to be crossed and the mismanagement of e-waste has contributed towards this phenomenon.[15] A concerted action by all actors to move away from such planetary boundaries through a circular economy is key to returning humanity to a safe operating space, but this must happen now. In the EU, which has some of the highest e-waste collection rates in the world, it has been reported that Member States are falling short of reaching the EU target of 65 per cent e-waste collection.[16] The amount of e-waste being generated is outpacing the collection rate.[17]

As presented in the Regional E-waste Monitor for Latin America,[18] Arab States,[19] and the Commonwealth of Independent States (CIS) plus Georgia,[20] e-waste management systems of countries can be categorised as either advanced, in transition, or basic. The same categorization could be determined for the level of EPR design and implementation. Across countries of various implementation levels, specific examples are in place or potential opportunities exist to provide complementary concepts, innovative solutions and tools to help drive national e-waste collection, with or without EPR-based e-waste regulation in place. Some of these operate across national borders.

E-waste compensation and offsetting

E-waste compensation is the concept of collecting and processing e-waste in order to compensate for the purchase of new or second-hand EEE. Similarly, offsetting is a reduction or removal of something made in order to compensate for the emission, production or generation of something elsewhere.

Figure 1: **Closing the Loop - E-waste compensation and offsetting**



There are several innovative approaches that use one of these two concepts and operate without the need to be steered by any form of EPR-based e-waste regulation. One example is Close the Gap,[21] a social enterprise that collects donated old and end-of-life EEE from European partners and refurbishes it for use in social projects in developing countries. Such a solution helps to increase ICT penetration rates in countries where new equipment may otherwise be expensive, and service partners in the destination countries ensure that e-waste generated from the donated EEE is collected.

The Great Lakes Initiatives for Communities Empowerment (GLICE)[22] in Burundi benefited from this early on in its mission to improve computer literacy, reduce the gender gap in access to ICTs and to encourage young people to take more of an interest in science and technology. GLICE also serves as an organization collecting e-waste, and in 2019, it collected 65 tonnes of old and end-of-life equipment.[23] GLICE reports back to Close the Gap on each category collected, including the quantity, type, brand, model, serial number, and the overall weight. It is unclear whether the figures reported to Close the Gap on the amount of e-waste collected in developing countries (such as Burundi) is being recorded in EU e-waste collection targets.

Other commercially driven actions are trying to solve the e-waste problem by offering compensation or offsetting as a service. The e-waste compensation model encourages EEE purchasers to pay a small fee to make their purchases waste neutral. The use of this service is voluntary, often driven by customer demand. One of the companies that offers this service is Closing the Loop,[24] a commercial entity that uses this fee to collect e-waste in developing countries.

In accordance with TCO Certified guidelines,[25] traceable collection figures are being recorded, but these are not yet being counted towards any national e-waste collection targets. Closing the Loop ensures that the collected e-waste is properly recycled locally or shipped to certified facilities. E-waste compensation creates additional funds, generated by European buyers and producers, for collection in countries that struggle with e-waste management.

Offsetting approaches exist in other sectors. For example, in some countries voluntary carbon markets[26] allow companies to offset carbon emissions through the purchase of carbon offset credits generated by green projects that target the removal or reduction of greenhouse gas emissions from the atmosphere. Similar to carbon offset credit schemes, plastic offset credit schemes enable credit holders to offset the amount of plastic waste they generate.[27] Both are examples of market-based mechanisms that drive private sector investment into projects to remove greenhouse gas emissions and plastic waste from the environment. At the same time however, it has been suggested that there is a risk that plastic waste crediting activities are not integrated into national approaches to waste management such as EPR and that they are often viewed as an alternative.[28] There has been little debate around the introduction of similar approaches for e-waste, but legislative changes have been made recently in India. The changes lay out a system for producers to secure EPR certificates that will certify the quantity of e-waste collected and recycled in a particular year by a producer. One producer may sell surplus quantities to another company to help it meet its obligations. Producers will have to register online, and the Central Pollution Control Board will monitor if producers are meeting targets.[29] But as already highlighted regarding plastic credits,[30] it should be ensured that such schemes for EEE do not undermine EPR systems.

Survey respondents indicated that such models will not solve the e-waste problem overall but that they could help some sectors in the short term. It is clear though that these solutions, driven by commercial responsibility, do provide buyers and producers anywhere in the world with an opportunity to do something extra towards e-waste collection, in particular beyond EPR-regulation based compliance. Some e-waste compensation solutions also provide, although modest in the grand scheme of things, an international framework for financing and sharing the costs of e-waste management across countries. The e-waste compensation model has been so far limited to products with perceived intrinsic value such as mobile telephones, tablets and laptops. Through the E-waste compensation as an international financing mechanism in Nigeria (ECoN)[31] project, as part of the PREVENT Waste Alliance,[32] the aim was to expand the product range to include batteries and monitors. This project has shown that the model is also proven for computer monitors, traditionally a negative value product. Both the offsetting and compensation solutions demonstrate a potentially different role of industry, still compliant but mostly outside of the EPR and collection target discourse.

Deposit return schemes

It is important to observe solutions being applied across other types of products and waste streams. A deposit return (or refund) scheme (DRS) comprises the payment of a deposit made upfront by the consumer on a product at the point where that product is purchased. A DRS is actually a combination of two instruments: a tax on the purchase of a certain product and a subsidy on the collection of the used one.[33] The deposit is returned to the consumer upon return of the product, at a designated point of return. A DRS is an example of a producer exercising responsibility over the post-consumer phase of the equipment it places on the market. Regarding the role of the informal sector in an e-waste collection system based around a DRS, to date, there is little understanding about what the positive of negative impacts would be for the informal sector.

The point where the product is purchased and the designated point of return are both important components of a DRS and their availability rely on the involvement of all actors, such as retailers in this case, not necessarily only the producers typically obligated under EPR. Consultees highlighted that for this to work, it is crucial that the

returned e-waste is delivered free of charge to a treatment facility chosen by whoever is responsible for funding the recycling. Deploying such a method to boost the collection of e-waste requires a strong retailer role, including brick-and-mortar retailers. The European Battery Association and others argue that DRSs must include retailers as they have the means to support such a mechanism,[34] yet it has also been highlighted that currently a large proportion of battery collections take place outside the retail sector such as at schools and at recycling centres and that it would be hard for these locations to participate in a DRS.[35]

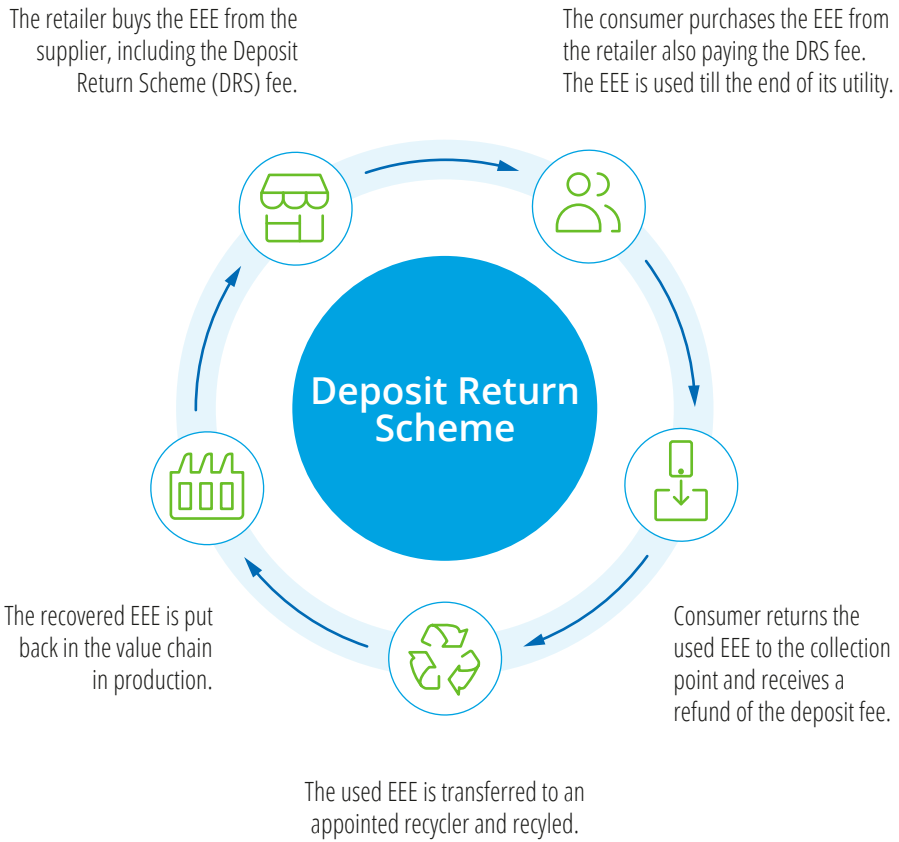
It has been shown that the provision of even a relatively small financial incentive, in particular receiving cash back, can change the behaviour of consumers towards returning old equipment.[36] Drawn from experiences predominately in other sectors, in particular with beverage bottles, DRSs can bring several benefits. The network of heads of European environmental protection agencies (EPA)[37] indicates that three main advantages exist: the fact that consumers are incentivized to return products ensures higher collection rates; more recycling is encouraged; and a closed loop return is made possible. Recykal, a technology-driven solution providerv from India for the waste management ecosystem, highlights other potential benefits[38] of implementing DRSs: they help to boost awareness about the segregation of waste and at the same time almost monetize the old and end-of-life equipment that consumers return.

Despite the positive portrayal of DRS, consumer perception plays a significant role. An e-waste collection awareness campaign supported by ITU and the UN Environment Programme in 2022 in Rwanda[39] found that despite the advertisement of prizes as part of the campaign competition, consumers still requested a financial payment from the recycler when dropping off e-waste as part of the competition. In some countries, the simple act of making e-waste available for collection comes with the expectations of a financial transaction.

Lindhqvist categorizes DRS as a part of the EPR principle.[40] Despite there being several benefits, DRS also comes with challenges. It is essential to ensure that an infrastructure is in place that accepts the return of different branded products across different locations. As with other EPR-based solutions, producers obliged to implement such schemes arrange themselves through a legal and organizational framework, for example, for distributors of one-way beverage packaging in Germany, this is done through Deutsche Pfandsystem GmbH (DPG).[41]

In many European countries, producer responsibility organizations and producer compliance schemes already exist in the EEE sector, which offers an organizational framework. Given that mobile telephones, for example, can differ in terms of components, value, materials, complexity and composition, it may be difficult to pursue a centralised DRS for all mobile telephone types, brands and editions. This means that DRS would most likely have to be producer led.

Figure 2: **Deposit return schemes**



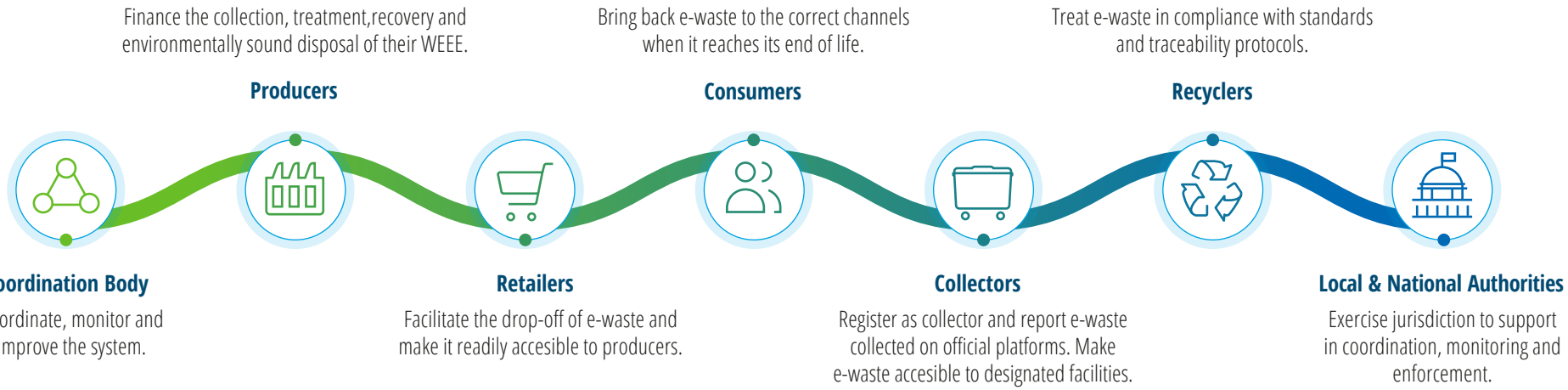
To identify viable products, labelling is a critical component for DRS. Labelling ensures quick identification of products in scope by all actors and minimises the risk of fraudulent activity by those trying to receive funds for products out of scope. Clear labelling can also help with auditing purposes, improving the ability and accuracy of product tracking. This could improve 'put on the market' data, the number of products sold, and the amount collected. Some have gone one step further by proposing a more competitive system, through an e-market for returned deposit EEE, a form of DRS, whereby consumers pay a deposit at the point of purchase. The difference is that reuse and recycling companies compete in the electronic market to receive the deposit by offering different rebates to consumers.[42] If companies choose to refurbish or resell the equipment then the rebate value to consumers may be higher.

Under German law, with backing from industry, distributors of automotive batteries are obliged to charge consumers a deposit of 7.5 euros including value-added tax if they do not return a used automotive battery when purchasing a new one. The deposit is reimbursed when a used automotive battery is returned.[43] But there have also been opposers of DRSs. When the EU was contemplating an EU-wide DRS for batteries, the European Battery Association and others argued that DRS makes sense for short-life products – such as beverage bottles – because of their high turnover plus the short timeframe between being placed on the market and consumed.[44] Others advocated for a supranational DRS highlighting that batteries are hazardous and that their co-mingled management with other waste streams such as lightweight packaging and paper poses fire risks[45]. Such a DRS would encourage the necessary separation. In the end, the plans for an EU-wide DRS for batteries were shelved.[46]

All-actors approach

The all-actors approach is a concept whereby producers and producer responsibility organizations (PROs) are appointed to fulfil collection responsibilities.

Figure 3: **All-actors approach**



The Global E-waste Monitor 2020 reports that only 17 per cent of global e-waste flows were officially reported as collected and responsibly recycled in 2019.[47].Some of it is estimated to be exported as second-hand products or e-waste, some of it remains stored away in homes[48] or passed on for reuse, whilst some goes into residual waste bins and the rest is possibly collected with scrap/and or scavenged. A leading group of stakeholders in the e-waste sector, including the WEEE Forum, argues that in many EU Member States only PROs and producers have been appointed as (sole) contributors for reaching e-waste collection targets.[49] Collection responsibilities are not assigned to all actors who have access to the various e-waste flows.

These stakeholders have called on the EU to fundamentally change its policy on e-waste[50] and to overhaul the current system of EPR, including targets, which they claim are not fit for purpose. Many EU Member States are facing challenges meeting e-waste collection targets. Based on recent research undertaken by the United Nations Institute for Training and Research (UNITAR) and despite enormous progress being made in tackling the increasing amount of e-waste being generated, the WEEE Forum has laid out three vital steps to be taken to ensure all actors are involved.

Firstly, all private and public entities who have access to e-waste and therefore are involved in the collection, logistics, preparation for reuse, refurbishment, treatment, or recycling of e-waste, or in the associated monitoring, legislative and enforcement activities, are subject to legal obligations regarding, amongst other things, compliance with national law and international standards and conventions, such as the Basel Convention, reporting to national and Basel Convention competent authorities when transboundary movement of e-waste takes place. The all-actors approach means that all stakeholders have legal obligations that competent authorities must enforce to ensure that all actors contribute in line with their requirements. This approach would result in more fairness and inclusivity in the market as well as enhanced monitoring based on sustained cooperation.

Secondly, PROs should only be required to collect the e-waste to which they have access, i.e. the e-waste deposited at collection facilities or handed over to them, but they should not be responsible for e-waste that is out of their remit; for example, e-waste treated as scrap metal.

Thirdly, authorities should implement measures to support the collection of e-waste. These include setting up a coordination body, improving collection networks and better monitoring e-waste flows.

For example, in Switzerland, the Ordinance on the Return, Taking Back and Disposal of Electrical and Electronic Equipment[51] obligates retailers, in addition to manufacturers and importers, to take-back e-waste. It also obligates consumers to bring-back e-waste to retailers, including via online platforms, and collection points. Municipalities also play a role in providing e-waste collection points, mostly in rural areas.

Collaborating with local actors

Many survey respondents alluded to the perceived intrinsic value and profitability for e-waste recyclers of specific materials that drives the formal collection sector. At the same time, other respondents strongly opposed the use of buzz terms such as “waste to wealth” and “gold in e-waste”, stating that such terms hide the real challenges and cost-implications associated with e-waste management. When asked what key lessons can be learned from the current deployment of EPR-based e-waste regulation, respondents noted a need for informal sector integration, global harmonization and a shift to more circularity.

Value from the collection of e-waste is derived not only by collecting more but also by elevating the price of materials contained within collected equipment. Employment and social impact opportunities also drive formal e-waste collection, in particular helping to integrate informal sector workers and closing the digital divide. The informal e-waste recycling sector generally involves the poor and marginalized groups who have little or no formal training.[52] The informal recycling sector may involve many hundreds of loosely connected people collecting e-waste who are under increasing threat from new regulation and becoming increasingly marginalised through its enforcement.[53]

Across Africa, a loose network of associations and initiatives is in place to boost computer literacy, the development of ICT infrastructure, capacity building, and e-waste management.

Computers for Schools Kenya (CFSK)[54] is a charitable non-governmental organization that sources personal computers for schools, provides maintenance support, establishes local area networks and supports Internet connectivity. CFSK also established the WEEE Centre in Kenya, which carries out e-waste collection and recycling activities. In Burundi, GLICE[55] is also modelled around reducing the digital divide and boosting digital inclusion, whilst focussing on the collection and recycling of e-waste. Its status is also non-profit and non-governmental.

Between Belgium and the Democratic Republic of the Congo, the Benelux Afro Center (BAC)[56] has been helping to bridge the digital divide. The non-governmental organization has been importing computers for educational purposes, working with Close the Gap to do so. In response to challenges of dealing with equipment when it becomes e-waste, BAC started specializing in the collection and recycling of e-waste and is recognized as the first e-waste recycling organization in the Democratic Republic of the Congo. The WEEE Centre[57] in Kenya was founded to respond to the same challenge of what to do with e-waste from the CFSK initiative. It too has been officially recognised as an e-waste collection and recycling facility.

Many of these initiatives started out as a solution to social issues but these have been extended to address environmental issues such as e-waste. These e-waste collection and recycling organizations, with an underlying objective to reduce the digital divide, have also established the Sustainable Digital Development Alliance (SDDA) for Africa, a social network (via Facebook) that stretches across Africa.

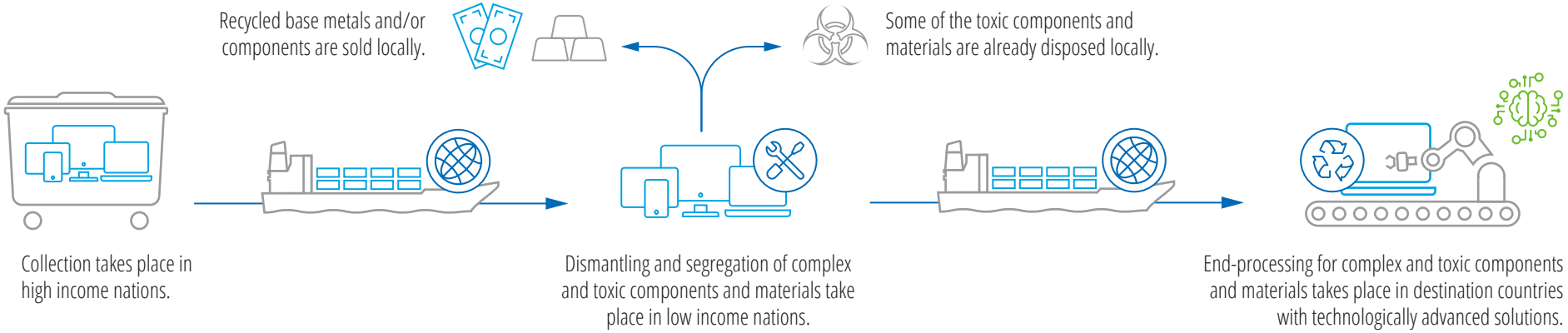
E-waste recycling companies are also creating employment and social impact opportunities in some African countries to drive formal e-waste collection by setting up training programmes for informal sector workers. Enviroserve Rwanda has trained informal sector workers and established an exchange programme of materials for repair in exchange for unwanted components.[58] In Nigeria, which is the second largest generator of e-waste in Africa,[59] Hinckley Recycling has trained informal sector workers to dismantle and handle e-waste.[60] Green Compass Recycling, by Sunray Ventures in Nigeria, set out to create both an environmental and socio-economic impact by registering informal e-waste collectors, helping them to open bank accounts whilst also providing vocational training.[61] Through the waste compensation model, companies such as Closing the Loop are able to pay a fair price for collected e-waste in countries such as Ghana and Nigeria while ensuring that personal health and safety and good social conditions are maintained. As reported by Recommendation ITU-T L.1034 Adequate assessment and sensitization on counterfeit ICT products and their environmental impact,[62] the lack of economic opportunities can open the door to counterfeit products: informal e-waste sites worldwide are considered major suppliers of essential parts, resources and materials to manufacturers of counterfeit ICT products.

In Colombia, the Fundación Puntos Verdes[63] is applying a model with an e-waste drop-off points system. The foundation takes care of the collection, transportation and treatment of e-waste and donates a large part of its profits to charities that are chosen by those registering and dropping off e-waste, including charities that support elderly people, children, animals and environmental issues. Each kilogram of collected e-waste counts as one point, which is redeemable against a donation to a charitable cause. It is unclear whether collected e-waste is officially reported towards national targets.

Best-of-two-worlds approach

This approach can be defined as a combination of recycling approaches distributed between developing and developed countries. For instance, in the proposed solution below, the collection part takes place in high income nations. Dismantling and segregation of complex and toxic components and materials then take place in lower income nations. As part of the pre-processing, the extracted valuable materials are sold locally and some of the toxic components and materials are already disposed. The remaining end-processing phase for complex and toxic components and materials then takes place in destinations where the necessary technologically advanced solutions are available. This approach provides a network for e-waste treatment in developing countries, by distributing recycling tasks to countries according to their complexity. In theory, this should increase the efficiency and effectiveness of treatment activities and create a demand for collected e-waste in each country.

Figure 4: **Best-of-two-worlds approach**



As part of the study behind this approach, pilot projects were developed. According to the authors of the study, a pilot project in China faced challenges relating to competition with informal sector workers. The cost of paying for e-waste plus the internalized cost for environmentally sound treatment meant that the pilot project could not compete economically with the informal sector. The study also indicated that the best-of-two-worlds approach still requires the presence, in some way or other, of e-waste regulation and financing .[64]

The presence of environmental policy and recycling standards facilitate proper channels for safe treatment and avoid cherry picking of only valuable materials.[65] Moreover, due to the varying market sizes for certain materials and market price fluctuations, stakeholders engaging in recycling activities still face high risks without a financing system in place as a safety net to cover any deficit.[66]

Nowadays, many countries aim to establish financing for e-waste management by using EPR as the environmental policy principle. However, only 40 per cent of countries are covered by e-waste management policy, regulation, or legislation.[67] Furthermore, not all of these instruments are legally binding, nor are they implemented or enforced. The study also emphasized that without the policy and financing preconditions in a developing country, the best-of-two-worlds approach may only have temporary success.[68]

Consultees indicated that one advantage of the best-of-two-worlds approach is that it has the potential for continuity. Looking closer at the topic of continuity, the implementation of this approach is more feasible when financing models that target responsible handling of the full scope of hazardous e-waste fractions can be found.[69]

Take-back schemes by individual producers

Individual producer responsibility (IPR) implies that producers bear the responsibility for the products they produce, in theory creating incentives for better design for end-of-life management.[70] As a result of EPR-based regulation, it is predominantly a collective of producers approach to EPR that is established by producers. In EPR-based regulations around the world, provisions allow producers to exercise individual responsibility, however, this is not common practice. For example, the Amendments to the National Environment Management: Waste Act, 2008 (Act No. 59 of 2008) in South Africa allow producers to establish and implement their own schemes. The same applies for producers in India under the E-waste (Management) Amendment Rules, 2018. Draft EPR-based e-waste regulations such as Article 25 in the Reglamento para la Gestión Integral de los Residuos de Aparatos Eléctricos y Electrónicos (RAEE) in Dominican Republic and the texts of the National Environmental (Electrical Electronic Sector) Regulations SI No 23 of 2011 in Nigeria make provisions for both collective and individual EPR schemes. For EU Member States, the Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), says that producers are allowed to set up and to operate individual and/or collective take-back systems for e-waste.

IPR can be achieved under collective EPR schemes but it becomes more costly and time consuming given that the EPR fee of each producer in the collective scheme must be differentiated based on data that highlights the share of the total e-waste flow of each producer.[71]The other options of e-waste collection and treatment regimes under IPR are to simply carry out individual collection with individual treatment.[72] Regardless of whether EPR-based regulation on e-waste management is in place in certain jurisdictions, some major electronics brands have initiated take-back and collection schemes for their products, across several continents. For example, Cisco operates a free of charge take-back programme for e-waste from both Cisco-branded and non-Cisco branded EEE. Cisco claims that the incentive for the consumer is the pickup at no cost. E-waste from other brands will be collected by Cisco in the instances where the consumer is purchasing Cisco equipment.[73] Apple also uses an incentive-based approach through its trade-in programme, whereby consumers trade in their devices for credit towards their next Apple product purchase, or they receive an Apple Gift Card. At the same time, old Apple products can also be dropped off free of charge at any Apple Store, without the requirement to purchase a new one.[74] Dell Technologies also collects e-waste directly from its consumers by providing a pre-paid postage label for the return of e-waste at post offices or through scheduled pickups.[75] At the same time, Dell Technologies also partners with Goodwill, a non-profit organization providing job training, employment placement services, and other community-based programmes for those with barriers to employment. Goodwill accepts e-waste from Dell Technologies products in over 2 000 locations in the United States of America.[76]

Beyond corporate social responsibility (CSR) reports, it is not clear whether any individual commercial approaches are reporting what is being collected, nor is it clear how they are collecting data and whether this could be harmonized with the methods used by other producers, producer responsibility organizations and governments.

Digitalization and digital product passports

Digitalization[77] is an enabler for the circular economy as it has the potential to manage, relate and process detailed and reliable data about devices and e-waste in terms of materials, supply chain traceability and impacts. One example is the digital product passport (DPP), a structured collection of product-related data with a predefined scope and agreed data ownership and access rights conveyed through a unique identifier attached to each product.

The DPP is a policy instrument anchored in several high-level strategies of the European Union – the European Green Deal, the Circular Economy Action Plan and the Council of the European Union conclusions on Making the Recovery Circular and Green. The conclusions pointed towards evaluating existing databases as well as the data collected under legislative instruments as a starting point, whilst ensuring the standardization of data sharing, interoperability and data use safety.[78] Significant challenges would be expected in terms of collecting the right data, but the suggestion is that such a passport could support e-waste collection and recycling approaches, and create more awareness, visibility and transparency about both the hazardous materials and the critical raw materials contained within the products.

In the context of EPR, opinions expressed by survey respondents and in consultations[79] generally indicated that too much emphasis is placed on the producer and not enough on the product itself, because obligations are measured by put-on-the-market data whilst there appears to be little support for a fee-and-tracking approach for each product. Some respondents suggested that DPPs could make a valuable contribution to e-waste collection rates by helping the producer community to estimate EPR fees more accurately for each product and by ensuring that this data is contained within the passport.

In addition, DPPs could create transparency and ensure traceability by providing stakeholders across the supply chain with information on product content and condition .[80] According to the Council of the European Union, such passports could enable tracking and tracing of products and contain information on origin and composition, including the presence of substances of concern, critical raw materials content, recycled material content, possibilities or instructions for re-use, repair and collection upon discarding, dismantling and handling as waste.[81] Standards development organizations, including the ITU-T Study Group 5 (ITU-T SG5) Environment, EMF and Circular Economy,[82] have started to study the standardization requirements for DPPs. ITU-T SG5 is developing the international standard on requirements for a global digital sustainable product passport that will include information relevant to sustainability, the environment and health, as well as climate change aspects, for ICT/digital devices in a common digital format. This standard is being developed jointly with the European Telecommunications Standards Institute Environmental Engineering (ETSI TC EE).

The scope of this standard is the definition of sustainability requirements for the reporting of useful details about digital technology products in digital format with focus on circularity and transparency to achieve a circular economy. Implementation of the DPP has implications for the electronics industry, regulators, consumers and other relevant stakeholders. DPPs should inform and be linked to existing databases that are relevant to the collection and processing of e-waste such as those that concern restrictions of hazardous substances.

The European Product Registry for Energy Labelling (EPREL) database was launched in May 2022 under the framework of the Energy Labelling Directive (2010/30/EU) ,[83] one of the framework directives related to the energy efficiency of products. It is important to consider that the DPP for EEE could also be a very influential tool for the consumer. Comparisons can be drawn from examples of energy labelling in use that impact consumer decisions. For example, the most efficient washing machine may have a high purchase cost, but for a large household, low running costs linked to electricity and water savings could compensate the high price. On the other hand, for a single person living in an apartment, a cheaper, less energy-efficient, but very silent washing machine might be the preferred option by the consumer.[84]

It is important to factor in consumer behaviour, choice and ultimately convenience. If such passports include information on what to do in terms of e-waste collection, then it must be made easy to access and understand this information. Without taking into consideration the price of the product, EPREL provides online information about various aspects of products ,[85] some of these already include EEE. The options, the accessibility and the convenience of local collection for the consumer could be built into the product scoring for products under different EEE categories.

Based on the ability of DPPs to make certain types of data available, end-of-life and end-of-use decisions regarding EEE by the consumer should be given as much priority as purchasing decisions when it comes to accessing data. If this is implemented effectively, DPPs could shift more end-of-life and end-of-use responsibility to the consumer and strengthen the important role of the product in EPR – as well as the producer

Public-private partnerships

Stakeholder collaboration between the public and private sectors plays an important role in some countries when it comes to increasing e-waste collection rates. In Rwanda, the *Regulation N°002 of 26/04/2018 Governing E-waste Management in Rwanda* states that an appropriate licence shall be held by the Rwandan Utilities Regulatory Authority (RURA) for any person carrying out e-waste collection, transportation, dismantling and recycling activities among others. The first company licensed by RURA was Enviroserve Rwanda. The collaboration between the Government of Rwanda and Enviroserve through a 10-year lease agreement has been signed by the Ministry of Trade and Industry and Enviroserve. The government constructed the facility through an investment of more than USD 1.5 million, with Enviroserve expected to operate the site, develop e-waste collection points around the country, boost recycling technology and carry out public awareness activities.[86]

Beyond signifying strong public-private partnership, the collaboration represents a different type of approach taken to other countries in the region. In this sense, Rwanda has attracted foreign investment and the government has a stake with a shared financial and operational responsibility that goes far beyond the facility itself. Skills in the e-waste collection and recycling sector are being transferred to local staff whilst the partnership is ensuring that e-waste management capacity and support across the country are being boosted through the establishment of a wide network of collection points and awareness campaigns supported by international organizations.

International cooperation

The international community, in particular the United Nations organizations and specialized agencies have been providing technical assistance, funding and knowledge exchange on e-waste management in many countries from as early as the early 2000s.[87] The provision of financial support and technical assistance for development projects in the area of e-waste management and EPR can serve as a vital catalyst for the future life of e-waste management systems based on EPR. This has been demonstrated, according to consultees, by the Global Environment Facility-funded project in Nigeria on circular economy approaches for the electronics sector. The project to date has helped the development and official publication of EPR guidance, the development of Black Box software for the EPR scheme, the development of a levy structure and the formalization of informal e-waste collectors. A partnership between ITU and the UN Environment Programme, started in 2021, has helped with the development of the legal regime, administrative arrangements and financing modality for e-waste under EPR in Rwanda. The partnership has also supported the Government of the Dominican Republic with the drafting of e-waste regulation.[88] Additionally, ITU has been helping countries with the development and implementation of international standards on sustainable e-waste management and the transition to a circular economy. ITU is a member of the Basel Convention Partnership for Action on Challenges relating to E-waste (PACE II) and is cooperating with the Basel Convention regional and coordinating centres for the implementation of pilot projects in developing countries and countries with economies in transition. The ITU standardization sector also cooperates with the Basel Convention for the development of e-waste management recommendations for the ICT sector. For many years, GIZ has led cooperation projects with countries, in particular in Ghana and India, that aim to boost e-waste collection, to integrate informal sector workers and to strengthen EPR frameworks.

Figure 5: **An international regime to tackle e-waste**

An international regime

The complementary actions referred to in the previous section could be strengthened and benefit from an international regime, with the objective of harmonizing the global approach to tackling e-waste.

The contents of such a regime could include:

1. The provision of guidance on different technologies.
2. The development of appropriate international tracing modalities for products and materials.
3. The preparation of a standard containing general treatment and depollution requirements.
4. The harmonization of various definitions, methodologies and principles.
5. The sharing of knowledge through twinning programmes and exchanges.
6. The creation and maintenance of a database or open data set for various features.
7. The understanding of the application of EPR across borders.

Governments have recently decided to adopt a New Global Treaty on Plastic Pollution[89] that would include legally binding provisions to prevent the toxic impact of plastic pollution. Major brands and businesses have played a role in the onset of this, claiming that a coordinated international response is needed .90 Aside from a selection of different partnerships and coalitions convening a relatively exclusive, but global, collection of partners and members, the electronics sector has remained fragmented. The E-waste Coalition, PACE II, the Circular Electronics Partnership, the Solving the E-waste Problem initiative, the Platform for Accelerating the Circular Economy, the Global E-waste Statistics Partnership (GESP), PREVENT Waste Alliance and the International E-waste Management Network are all examples of independent partnership initiatives.

Chatham House recently commissioned a *Global Roadmap for an Inclusive Circular Economy*[91] for Stockhom+50, an international meeting convened by the United Nations General Assembly. The roadmap suggests that a coalition of industry and civil society actors could address illegal transboundary movement of e-waste by:

a) improving the implementation of the Basel Convention Prior Informed Con sent Procedure and its environmentally sound management provisions;

b) supporting information-gathering on e-waste trade for appropriate recycling and pilot projects within regional groups or between key trade bilateral partners.

The roadmap argues that such a coalition could create new momentum and build on existing partnerships and coalitions with a joint secretariat representing both government and industry to ensure coordination.

An international regime – a grand coalition – will bring together governments, industry, academia and civil society and include several objectives:

To develop guidance on different technologies: In many countries, the recycling and refurbishment industry is still emerging. Major technological gaps exist in particular for the processing of hazardous components, critical raw materials and plastics in e-waste. In some places, separation technologies are not well developed. Where there are small scale operations, the existing technologies are often not suit able nor economically viable.

The revised Guidelines on Environmentally Sound Material Recovery and Recycling of End-of-life Computing Equipment[92] by the Basel Convention Partnership for Action on Computing Equipment (PACE) could serve as a basis for such guidance. Following the adoption of amendments at the 15th meeting of the conference of the parties (COP) to the Basel, Rotterdam and Stockholm Conventions, there will be an analysis of current guidelines to see if they reflect these amendments. This will be submitted to COP16 in May 2023 and the COP will consider if the current guidelines should be updated. Governments are mostly tasked with disseminating guidance such as that produced under PACE. An international regime with the means to engage local recyclers regardless of operation size and to communicate the basics of the guidance, also in local languages, may improve take-up.

Although the Basel Convention covers all the above-mentioned aspects, it currently lacks an appropriate financial mechanism, such as the Global Environment Facility available for the Stockholm Convention on Persistent Organic Pollutants or the Minamata Convention on Mercury.

To develop appropriate international tracing modalities: There is little comparison in the ability to trace products across a supply chain between the stages before a product is used by the customer and the stages after use. Wal-Mart was one of the pioneers of using RFID chips across its supply chain in collaboration with the brands it sells. Using RFID enables inventory tracking as a product moves across the supply chain, e.g., from the manufacturer to the distribution centre, to the retailer and on to the shelf.[93] After the useful life of a product, the nature of the moral responsibility changes in terms of where the product goes next, the customer and the waste management company, charity, neighbour – or whoever receives the e-waste from the original customer – play a significant role.

One of the more recent pioneers of supply chain management, Amazon, highlights several challenges[94] with the supply chain stages from the manufacturer to the consumer, which mirror some of the challenges being faced after the product use by the consumer. This includes ensuring all parties have the right information available, overcoming paper-based processes and safeguarding product quality. There are numerous examples of digital tracing solutions, such as Blockchain, being developed by large producers in other sectors. IBM has launched a platform for companies to test blockchain

record-keeping technology in their supply chains,[95] and Toyota has established a Blockchain Lab to support supply chain efficiency and traceability to share information on manufacturing and shipping of parts,[96] whilst Wal-Mart has piloted blockchain for food traceability, using an IBM solution.[97] Product life cycle management, which includes DPPs, will be a focus area of the new European Blockchain Services Infrastructure, a joint initiative with the European Commission. An international regime could play an important role in promoting technology and innovation and to strengthen the growing policy dimension around tracking and tracing of end-of-life and end-of-use EEE. Thus, such a regime could help forward current deliberations around the feasibility of DPPs.

To prepare an international baseline treatment and depollution standard: The role of international standards covering e-waste is extremely important. ITU has been leading this process with the publication of several international standards for practitioners such as Recommendation ITU-T L.1021: Extended producer responsibility – Guidelines for sustainable e-waste management[98] and Recommendation ITU-T L.1030: E-waste management framework,[99] among others. At the time of writing, ITU is convening the preparation of a new international standard on the collection, treatment and disposal of e-waste. Many consultees expressed the need for a minimum level of guidance or specifications for the treatment of e-waste, to serve the growing number of enthusiastic entrepreneurs and associations organizing themselves around these activities globally. An international regime could investigate whether it is feasible to apply the same basic specifications for particular e-waste treatment activities in any country in the world, and also which activities. Understanding the uptake of CENELEC standards by EU countries could provide a good indication as to whether a minimum standard globally could be an effective approach.

Several approaches exist in different regions that aim to create a level playing field for e-waste management, such as the CENELEC EN 50625-1 series of standards, which is the reference standard for e-waste treatment in Europe, the Recycling Industry Operating Standard, the Responsible Recycling (R2) standard and e-Stewards. There is little harmonization across these different approaches but collectively they may contain baseline ingredients that could be applied anywhere in the world and disseminated by an international regime. E-waste recyclers need to be able to afford to apply the standards imposed on them. A minimum international standard would be beneficial so that recyclers in developing countries could meet without too much cost, which would increase their chances of securing business contracts with international recyclers. One approach to trialling such a standard would be to develop standard operating procedures (SOP) in a country for such a baseline standard and its dissemination, similar to the SOP for environmentally sound management of used lead-acid (ULAB) batteries developed by the Sustainable Recycling Industries initiative. The developed SOPs total 37 sheets, each covering one topic relevant for safe and environmentally sound ULAB management, from collection to recycling.[100]

The International Electrotechnical Commission (IEC) has also identified the need to extend the reach of existing transnational standards,[101] such as those referred to above, to include developing nations, to have a global standard on e-waste. If the reach of existing standards is to be extended, barriers to access must remain low and contents must remain accessible to those operating recycling services formally or informally. PROs could help with the dissemination of such a standard whilst Basel Convention focal points alongside national standards bodies in each country could help with transposing relevant principles locally.

To harmonize definitions, categories, methodologies and principles: The adoption of EPR-based e-waste regulation is increasing globally and creating new obligations for manufacturers, importers and distributors of EEE. There are already common trends in the definition of a producer, and this has been highlighted in ten countries in Africa.[102] These include the use of terms such as persons carrying out manufacturing, importing, distributing, converting, assembling, introducing and shipping. An international regime could help work towards regional harmonization of EPR-based e-waste regulation. For example, in Africa, countries are grouped into regional economic communities (RECs), which play a crucial role in a wide range of integration activities. These RECs could serve as platforms for launching harmonization efforts in Africa in the field of e-waste.[103] Due to similar characteristics and certain levels of integration with such regions, these RECs could serve as a start.

Some common principles on how to build EPR-based e-waste regulation should be promoted through an international regime – with significant involvement of governments globally. Such principles could include stakeholder definitions, roles and responsibilities, scope of the products to be included, stipulations on enforcement measures and penalties for non-compliance, details on financing mechanisms and institutional structures, such as a PROs, and clear stipulations on who covers the cost of e-waste management. Harmonization across countries of EEE categories in e-waste regulation could be an action taken up by an international regime, in addition to providing training on the harmonized collection of e-waste data and reporting, which is currently carried out by the GESP. Efforts could also be made to harmonize the registration of producers so that they would essentially follow the same procedure, independently of the jurisdiction in which they operate.[104] The types of products included under EPR-based e-waste regulation may be very broad, as is the case in India and Rwanda. Whilst in Australia, the National Television and Computer Recycling Scheme has been very successful in collecting and recycling televisions and IT equipment but it does not cover other categories of EEE such as small appliances, major appliances, solar and medical equipment, toys, consumer electronics and power tools. In the EU, the types of products included are broadly based around their characteristics and are harmonized in Annex 3 of the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE).[105]

To twin producer responsibility schemes: Several PROs are collaborating through a twinning initiative[106] led by a WEEE Forum with the objective of assisting emerging PROs to establish their operations. This is already an international activity where experienced PROs that are current members of the WEEE Forum provide knowledge sharing to those PROs based in countries where an EPR system has only recently been established. Currently, the exchanges are of a purely knowledge-sharing nature. The twinning initiative does not take into account the growing number of e-waste associations in various developing countries where no regulation on e-waste management exists, where different types of knowledge may need to be exchanged, such as minimum guidance on treatment technology or baseline standards for treatment and depollution. Reflecting the PRO Twinning initiative, an international twinning network between e-waste recyclers could be extremely helpful for those entrepreneurs, small businesses and associations setting up e-waste collection and recycling activities in different countries. This could also be achieved through joint ventures between PROs and treatment facilities under the existing PRO Twinning initiative, for example giving an opportunity to disseminate baseline requirements, such as those adapted from existing e-waste standards used around the world. The European Electronics Recyclers Association[107] is an example of an entity acting as the voice of European e-waste recovery facilities.

To create, manage and update global databases: Several opportunities exist to create databases on various aspects of e-waste, these could include:

- a global database on the collection and storage of data on generated and collected e-waste;
- a database on repairability instructions for various EEE;
- a regional or global list of second-hand EEE importers.

There is very little data about the companies importing second-hand EEE and about how much is being imported globally. On the one hand, there is no global registry or reporting obligation for used-EEE transboundary movement under the Basel Convention.[108] In this regard it would be important to develop more transparency to better understand the whereabouts of second-hand EEE being exported to developing countries. On the other hand, the Basel Convention does provide a database[109] of national definitions of hazardous wastes and restrictions on movements of waste.

Towards Zero Waste[110] is a Swedish company that provides a digital marketplace where users can find a buyer for EEE to reuse and where users can find e-waste recyclers. Theoretically, the platform allows producers to exercise individual producer responsibility in any part of the world. If a producer is selling a certain number of laptops in a given country, the producer could make a request for recyclers in that country and arrange a contract for the collection and recycling of the equivalent amount of e-waste.

Access to data about e-waste generated and collected and on the importation of second-hand EEE is limited. The introduction of the HS code (8549)[111] on electrical and electronic waste and scrap might improve data collection but more disaggregation of HS codes is needed to support data collection globally. The OCED recommends a single electronic register of producers for each jurisdiction with a form for those who are non-registered to be reported.[112] An international regime could support the standardization of such a registration process, including the register itself, which could improve implementation by regulators globally for those countries having EPR-based regulation, not just for the electronics sector.

To better understand the application of EPR across borders: EPR has grown to become an exclusively national policy approach involving all concerned actors within the borders of the concerned jurisdiction. But recently academics have been advocating for a new approach called ultimate producer responsibility (UPR). In fact, a petition in early 2022 demanded that the European Commission and the Government of Nigeria organize repair and recycling for imported second-hand EEE to Nigeria and for e-waste imports under what would essentially be global extended producer responsibility.[113] UPR would take into account a financial transfer mechanism from EU-based EPR schemes to those in developing countries. Among other points, the following section includes a detailed review of the proposed UPR. Academics are beginning to explore the possibilities for expanding EPR schemes across borders. Private sector organizations, such as Towards Zero Waste, have also been exploring how global EPR for e-waste could be introduced, but virtually through their digital marketplace. A recent study by the company identified the need to transfer responsibility over borders and to trace the origin of EEE.[114]

Figure 6: **Upsourcd – A digital marketplace across borders**

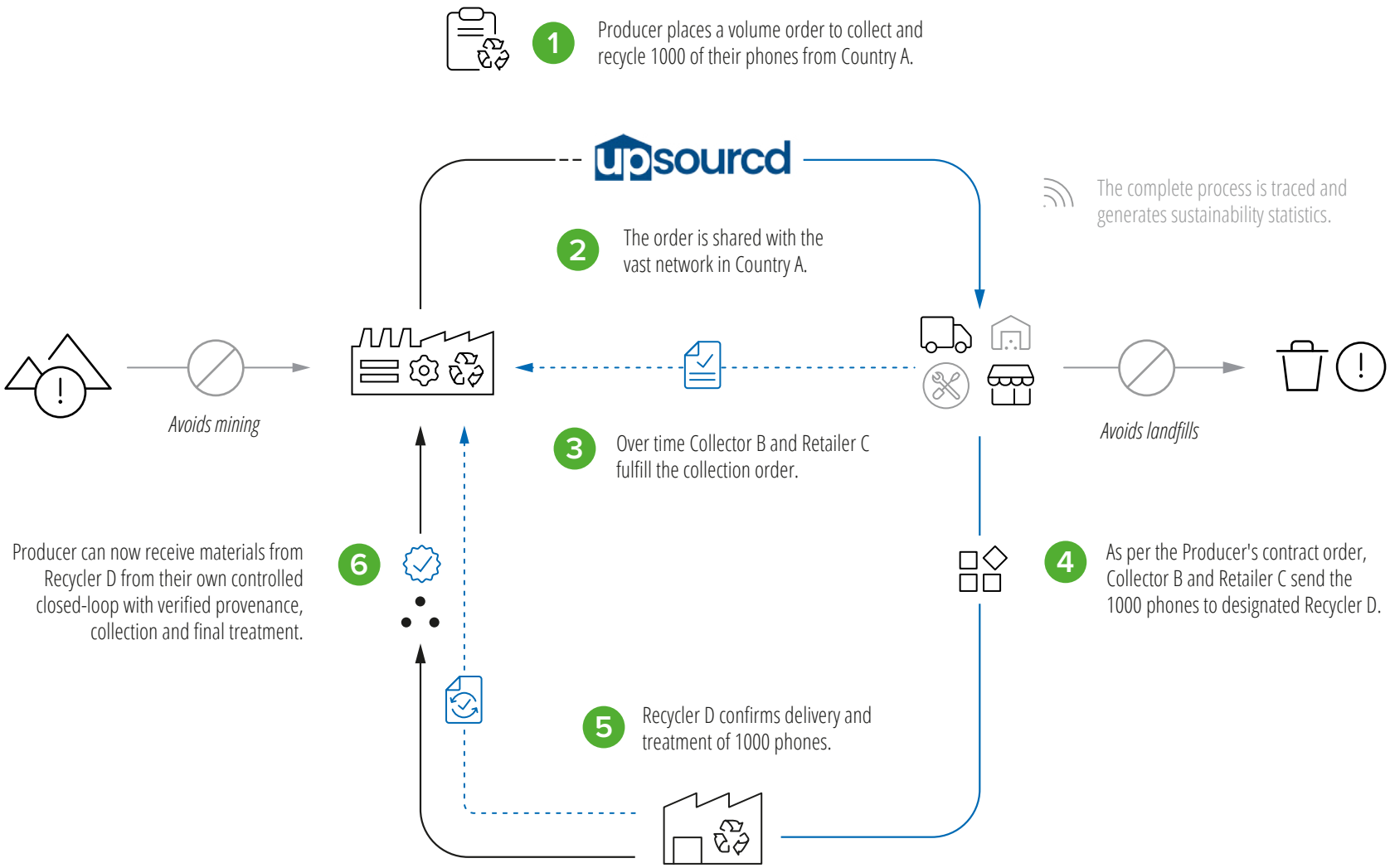
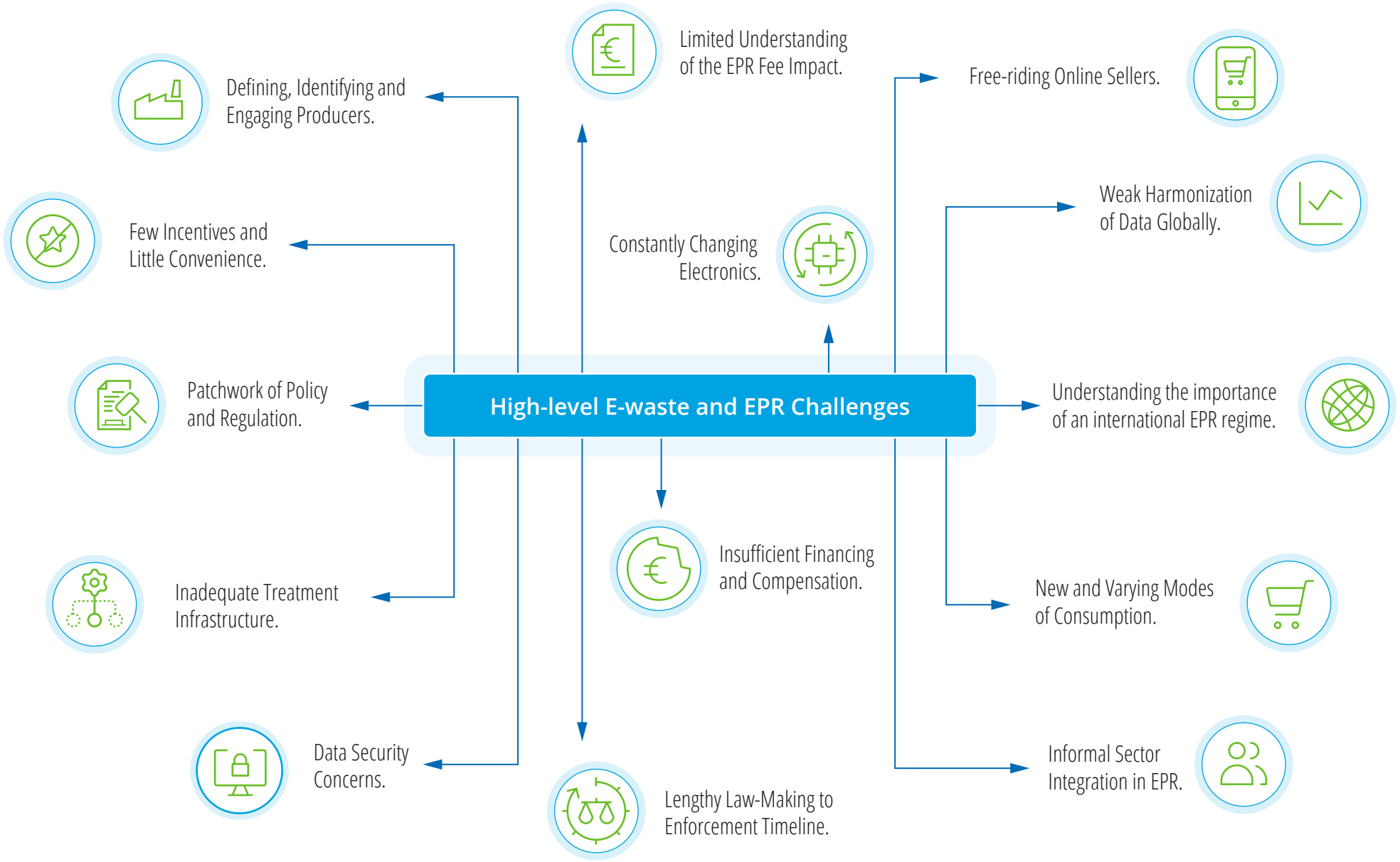


Figure 7: **High-level e-waste and EPR challenges**



High-level EPR and e-waste challenges

Survey respondents and consultees generally indicated that EPR is a good environmental policy principle because it has helped to increase collection rates, albeit predominately in Europe. The take-up of collective EPR is currently prevailing over IPR because compliance options for producers are being limited as a result of EPR-based e-waste regulation favouring collective EPR, according to consultees.

Some survey respondents indicated that IPR removes the notion of a level playing field and that it creates challenges for those collecting and sorting waste streams to find the specific products under a particular IPR scheme, moreover it was emphasized that there is a need for harmonization of EPR approaches. Concurrently though, consultees disagree with the approach of copying and pasting existing EPR approaches in countries developing this type of regulation for the first time.

Ultimately, the EPR principle is not the regulatory instrument itself, it provides the basis of the e-waste regulation. If EPR-based e-waste regulation is developed through stakeholder consultation and public participation, then it can be adapted to local needs. Many survey respondents and consultees pointed out the aggressive nature of e-waste collection targets and linked this to EPR. However, it is the regulatory framework that sets collection targets, not the EPR principle. Despite this, even if it is enforced, many producers in particular small and medium-sized enterprises are not aware of the EPR-based regulation.

EPR-based e-waste regulation places significant emphasis on collection. But in many net-importing countries, the distinction between the activity of collection and the activities of recycling, remanufacture and resale is not clear. The entity remanufacturing and reselling EEE may also be collecting the equipment when it is e-waste. EPR-based regulation would classify local remanufacturers and sub-assemblers as producers and thus aim to register them with the EPR system. This may come as a disincentive to those small and medium-sized enterprises and entrepreneurs whose operations include repairing and remanufacturing old and end-of-life EEE and reselling it, a business model that is more circular than having the equipment collected immediately and recycled. This also demonstrates that different opportunities and challenges exist depending on the country.

Understanding global EPR

Firstly, the potential commonalities of EPR approaches globally have not been identified. This would ultimately help with the harmonization of e-waste management across countries. Secondly, the study into the implications of extending national EPR schemes across borders is an under-developed area. Lastly, thus far there has been no truly effective global mechanism to convene stakeholders around these two aspects of global extended producer responsibility.

The concept of UPR, associated with the implications of extending EPR schemes across borders, argues that traditional EPR does not address the multiple-use cycles and cross-border trade of second-hand devices and of e-waste, which could lead to producers shifting responsibilities under 'polluters pay' principle to countries without sound e-waste management capacities.

UPR is defined as the fairness-based financial responsibility for collecting and recycling e-waste by manufacturers, no matter where the product is finally discarded, collected and recycled.[115] This essentially means that UPR calls for international collaboration towards the extension, in some way or other, of an EPR scheme of one country into another. A Nigeria case study provided by university-led researchers behind UPR reports on the importation of used EEE into Nigeria and revealed that about 60 000 tonnes of used EEE shipped into Nigeria in both 2015 and 2016 originated from EU ports.[116]

The person-in-the-port (PiP) study studied some 201 containers and 2 184 roll-on / roll-off vehicles with used EEE and reviewed 3 6 22 import documents of used EEE.[117] The study also highlighted that, on average, 1 out of 143 imported containers was found to contain used EEE.[118] According to a study on e-waste collection rates and targets in the EU, and Iceland, Norway, Switzerland, and Sweden authorities indicated via correspondence that exportation of EEE for reuse is one of the factors leading to a decrease in the WEEE collected in Sweden – from 18.4 kg per inhabitant in 2013 to 14.1 kg per inhabitant in 2017, but authorities could not produce exact figures on exports for reuse.[119] This report also noted that second-hand EEE exports, for the products covered, doubled from 5 000 tonnes in 2008 to 10 000 tonnes in 2013.[120]

Others have noted that of the smartphones collected through trade-in programmes in the developed world, 30 per cent are sold in developed markets and 70 per cent are sold in emerging markets, as export costs are cheap and brand name devices are in high demand.[121] One of the main challenges for understanding the value of UPR is the lack of data on second-hand EEE trade, which makes it very difficult to justify the alteration of EPR schemes in one country to support with e-waste management in another. The ProSUM Report[122] provides the basis for a large amount of data relied on today, while it remains a constant challenge to collect import data from Member States under the Basel Convention national reporting[123] database, with less than 50 per cent submitting reports about e-waste.[124] Low reporting levels of transboundary movements makes it challenging to truly determine transboundary e-waste flows, but latest estimates suggest that 19 per cent of e-waste generated (2.9 metric tonnes per year) in Africa arises from imports.[125]

Several supranational and international changes to the policy environment around e-waste and the circular economy may suggest that the timing of the UPR concept is uncertain. Extending EPR schemes across borders may be contradictory to current

European policy on the circular economy such as by exploring options for an EU-wide take back scheme to return or sell back old mobile telephones, tablets and chargers and making electronics and ICT a priority sector for implementing the right to repair, including a right to update obsolete software.[126] At the international level, the Basel Convention at its 15th meeting (COP15) agreed by consensus to list under the Convention both hazardous and non-hazardous e-waste in line with the "Swiss-Ghana Amendments Proposal". Coming into force on 1 January 2025, the amendments will establish new codes and definitions for hazardous and non-hazardous e-waste, ensuring that both these e-waste categories will be moved across borders following the prior informed consent procedure (PIC) under the Basel Convention. The PIC procedure requires consent by all States involved prior to the export, import and transit of e-waste.[127] As a result, all transboundary movements of e-waste involving parties to the Basel Convention will be certified and traceable. This may lead to less transboundary movement, a situation that will be emphasized by the fact that the EU includes "other wastes" listed in Annex II (which will include a new code for non-hazardous e-waste) in its export prohibition to developing countries. On the other hand, this could also result in enhanced investment in recycling and final-disposal facilities and closer proximity of where the e-waste is generated and where it is treated and finally disposed.

The Countering WEEE Illegal Trade project from 2015 noted that the main driver behind exports is the reuse value combined with the avoided costs of sorting, testing and packaging,[128] which is supported by the fact that second-hand EEE implies a lower cost to the consumer, and the second-hand market is likely to continue growing whilst remaining informal and decentralized.[129] At the same time it is in the interest of brands to expose their products (as second-hand) in new markets, whilst in parallel reducing the digital divide.

As mentioned, many governments are developing national e-waste regulations based on EPR. EEE put on the market in the Netherlands, for example, is subject to EPR obligations under the Dutch Waste Electrical and Electronic Equipment (WEEE) Management Regulations.[130] Nigerian authorities have also established EPR-based regulation[131] and are in the process of registering producers as part of the new EPR system. Producers must exercise EPR obligations in Nigeria under the e-waste regulations similar to those registered in the Netherlands. As an alternative to expanding EU EPR schemes across borders, more support could be provided to national governments of developing countries to improve their electronics EPR regulatory frameworks and their implementation. As referred to earlier, the PRO Twinning initiative has been established across borders by the WEEE Forum to support the exchange of personnel, knowledge sharing and financial support with membership fees.[132] The initiative does not include financial support for EPR implementation such as covering the end-of-life and end-of-use costs of e-waste or shipped second-hand EEE that becomes e-waste. Consultees indicated that if EPR fees from EU countries are spent overseas this would likely increase the demand for imports by countries outside the EU as it may appear to be a "hand-out".

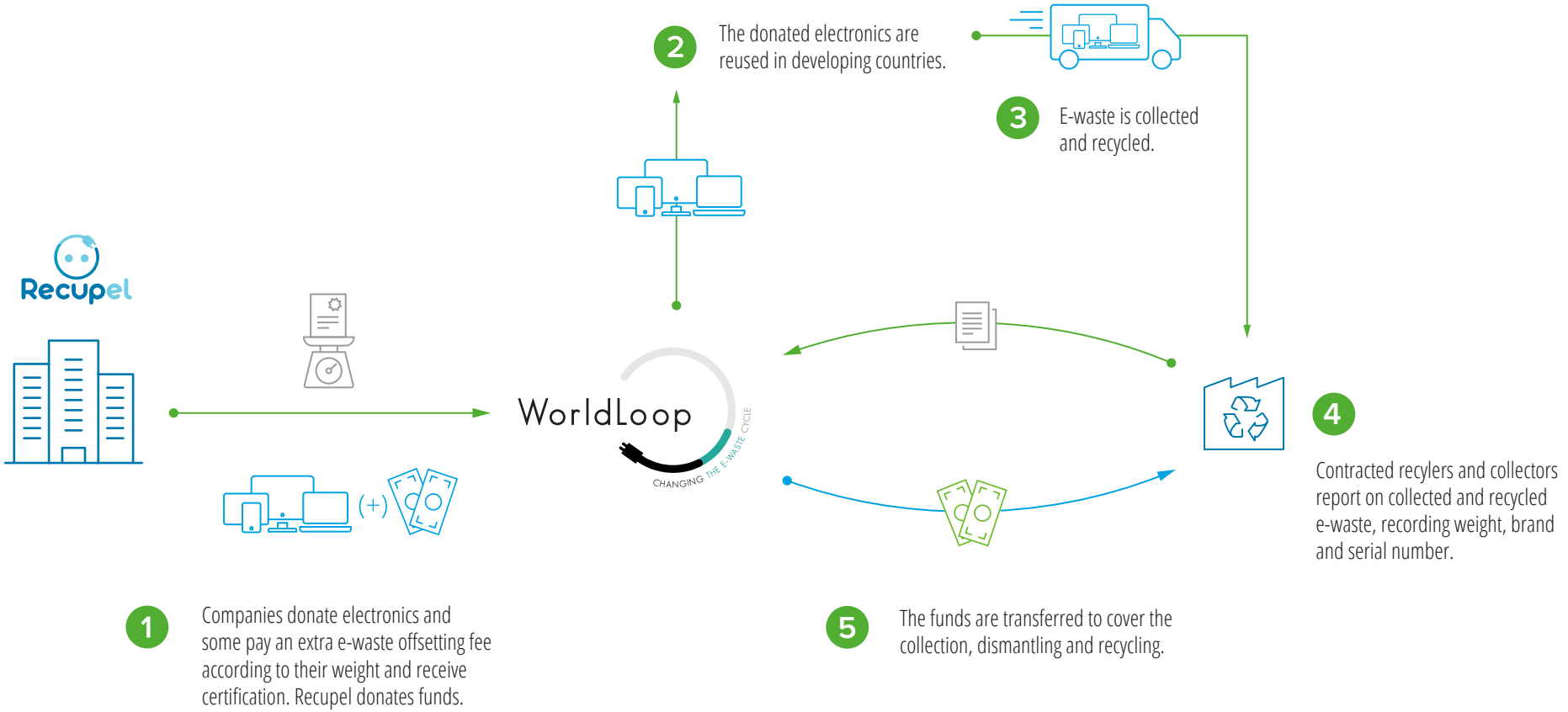
Under the UPR concept it is not clear how the EU country of origin would be determined and what the price would be for e-waste and second-hand EEE arriving from the EU, for example. More specifically, it is not clear how responsibility would be allocated to the specific EPR scheme within the EU country of origin of the exported e-waste or second-hand EEE. In the United Kingdom alone, for example, there are 14 WEEE approved compliance schemes.[133] Moreover, EPR fees are currently calculated based on the weight of EEE placed on the market in a given country. The methodology to determine the transaction amount between one country and another based on the UPR concept would inevitably be very different – not least because it would be export-led rather than import-led. As mentioned, there is also little reliable e-waste trade and put-on-the-market data available for second-hand EEE to feed such a reliable fee calculation model.

Consultees suggested that the answer to part of the challenge of second-hand EEE trade, which is being traded for meaningful reuse, may lie with the buyers and distributors. But the question arises as to whom they are exactly. A contract could be established between the buyer and the distributor of second-hand EEE. For example, a second-hand EEE company in country A sells EEE to a second-hand EEE importer in country B at a discounted price agreed on a contractual basis, with the agreement that the company in country B returns locally produced e-waste of a similar value or weight to the company for processing in country A. This solution is similar in nature to the existing commercial services, not-for-profit models and academic theories of Closing the Loop, Close and Gap/World Loop with the former claiming their model fits the best-of-two-worlds philosophy.[134]

There are few examples of financial transactions by PROs from the EU for the purpose of directly collecting e-waste in countries outside of the EU. According to consultees, Recupel, a Belgian producer responsibility organization (PRO), contracted World Loop to use local e-waste collectors and recyclers, and several multinational corporations provided funding to Close the Gap in addition to the old/used EEE that they donated.

The funding operation mechanism between Recupel and World Loop covered hazardous and non-valuable fractions, whilst the local recyclers generated their own revenue from the valuable components contained in the collected EEE. The local partners only received a payment from World Loop ex-post – once they returned the collected e-waste – reporting on weight, brand and serial number. Close the Gap provided e-waste certificates to the multinational corporations involved based on what was collected and reported. The fee calculation model was based on a methodology defined by Close the Gap that included estimated costs of collection and recycling by local partners in the country involved.

Figure 8: **World Loop - Funding e-waste management in other countries**



Few incentives and little convenience

Giving access to e-waste collectors and recyclers is critical to reduce the consumer burden associated with discarding old and end-of-life EEE, such as bringing back equipment to places where similar equipment can be purchased, dropping off e-waste at conveniently located collection points or trading-in one product for another. E-waste remains an issue not easily understood by consumers and the public in general, which could be due to shortcomings in communication around the issue in particular in comparison to the significantly greater levels of public awareness around single use plastics. The complexity of systems related to EEE and how to properly deal with each waste stream contribute to the confusion on how to discard e-waste.[135]

Awareness campaigns coupled with financial returns, such as cash back or coupons or environmental and societal incentives[136] have worked in some countries, for example where consumers expect a financial transaction when making e-waste available for collection, whilst in other countries, handing over e-waste is simply an ethical decision. Incentivization can also apply to e-waste collectors, particularly for informal sector e-waste collectors, to encourage the deposit of e-waste at environmentally sound treatment facilities. This has been piloted in Ghana with the support of GIZ, where e-waste is handed over for recycling for a payment.[137] E-waste collectors returning cables to the project handover centre were compensated via mobile money or cash up to a certain amount in instances where individuals had no access to a mobile money system. In 2022, a government-led e-waste collection awareness campaign in Kigali and Musanze District, in Rwanda, supported by ITU and the United Nations Environment Programme,[138] found that despite prizes (such as refurbished laptops and mobile data) being made available as part of a "Drop off and Win" competition, participating individuals still expected payment from the participating recycler, Enviroserve Rwanda Green Park.

Consultees highlighted that retailers are well placed to provide efficient and convenient return mechanisms for most e-waste. This includes distributors and brick and mortar retailers. Municipalities also play an important role as they own land, operate basic services and amenities and engage closely and locally with citizens. The recently amended German Electrical and Electronic Equipment Act has set forth new take-back obligations in 2022 to increase the role of some retailers in accepting e-waste.[139] EPR must not be exclusive and all stakeholders who have access to e-waste must play a role. Innovative examples exist from some countries where stakeholders beyond the municipalities and the retail sector have engaged in e-waste collection. In Sri Lanka in 2020, the postal service in collaboration with the Central Environmental Authority started collecting e-waste once a week. This essentially added 7 000 postmen to the country's e-waste collection efforts.[140] A similar initiative exists in several cities in Switzerland where the producer responsibility organization SENS eRecycling is working with the postal service by offering the Electro Bag to householders who would like e-waste collected from their doorstep.[141] In many countries where the postal network reaches the public's front door, this provides natural reverse logistics because there is a network of post offices and a fleet of postal vehicles.

Electrão, a producer responsibility organization (PRO) in Protugal, has set up collection points in accessible locations, such as fire stations, to make dropping off e-waste more convenient for the public. Electrão is also working with the municipality of Lisbon to offer door-to-door collection services for large household appliances to boost collection rates. Other companies have similar door-to-door e-waste collection business models, such as Retrievr from the United States.[142] The company is supported with a certain amount of cost coverage by specific EEE producers, but this does not prevent Retrievr from collecting other brands of EEE producers, although the scope of EEE accepted by the company is limited to products with intrinsic value and low weight. A similar local solution has begun in Brighton and Hove in the United Kingdom. The Tech Take Back initiative[143] relies on volunteers, but it is formally supported by the City Council. Unwanted laptops, mobile telephones and small appliances can be dropped off and will then be refurbished and donated to charities.

To increase the recycling of mobile telephones, tablets and other devices, an incentive scheme was developed under the CIRC4Life project in the EU. Consumers could dispose of e-waste in intelligent bins, and when doing so they can scan a QR code via the CIRC4Life mobile app in order to receive eco-credits.[144] The credits can be used towards tree planting or towards discounted EEE purchases in participating stores. A lot of convenience-based initiatives such as those referred to above make it easier for consumers to discard a limited range of appliances only. In some countries, the visibility of a recycling fee on the receipt is believed to be enough to incentivize the consumer to responsibly discard of their purchased EEE once it reaches its end-of-life or end-of-use.

Defining, identifying and engaging producers

A large number of countries are net-importers of EEE, meaning there is limited manufacturing of EEE locally, aside from the activities of sub-assemblers and remanufacturers. However, both are normally defined as a 'producer', whilst importers and distributors of EEE, although not manufacturing EEE, are also normally defined as a 'producer'. Such differences can create confusion for government stakeholders when designing an EPR regulatory framework, especially given that the term 'producer' is used collectively. EPR-based e-waste regulation is national in scope, and entities registered in country are subject to those national EPR obligations. In 2016, Ghana passed the Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917)[145] and legislative instrument Hazardous, Electronic and other Wastes (Classification) Control and Management

Regulations, 2016 (LI 2250). Initially the system faced challenges posed by definitions. Ghana is a net-importer of EEE, which is brought in primarily by importers and distributors. Thus, manufacturers themselves are not practically responsible for their products entering the Ghanaian market. Initially, the limited definition of a 'producer' meant that the vast majority of actual 'producers' were not covered by regulation.[146]

Identifying and engaging producers with the objective to register them infers significant challenges for governments. It takes time and requires significant effort, outreach and resources. There may be several hundred or even thousands of producers in a country and many may be importing on behalf of international brands and in small quantities. Due to limited research, it is unclear whether the local implications of EPR applicable to importers and distributors in a given country directly affect global brands. To support governments in identifying and registering distributors and importers, global brands could inform their supply chain about producer obligations in each country where their products are sold. Primarily, the alternative option for governments is to work with customs and chambers of commerce to attain lists of local businesses in the EEE sector.

Inadequate treatment infrastructure

Typical financing models associated with EPR are not designed to pay for upfront capital costs required by treatment facility development, thus initial government or private sector investment can be influential. In most countries across Africa, there are at least one or two companies (or associations) carrying out e-waste treatment activities, albeit on a relatively small scale, such as Namigreen[147] in Namibia, TCH E-waste[148] in Zambia, AST Recycling[149] in South Africa and Botswana, Chilambo General Trade Company LTD[150] in Tanzania, GLICE[151] in Burundi, the WEEE Centre[152] in Kenya and Hinckley Group[153] in Nigeria. In Rwanda, the government has signed a public-private partnership with Enviroserve Rwanda Green Park[154]. The Rwanda Government approach to tackling e-waste has been to approve an EPR-based regulation[155] whilst also establishing a public-private partnership with Enviroserve. However, in all of these countries the aforementioned recyclers have been in operation despite the absence of a fully operational national EPR system.

The rudimentary management of e-waste due to the lack of environmentally sound treatment infrastructure can hinder the extraction of resources that could be resupplied to new products. Countries characterised by large uninhabited areas with intermittent urban areas can face extra challenges since facilities are often far from collection points, which increases fuel costs. The high costs associated to the process of collecting and transporting e-waste (due to distance) makes e-waste management more challenging in such contexts[156]. It is important to ensure a balance between initial investment in treatment infrastructure whilst developing EPR-based regulation to ensure e-waste collection over the long-term.

Informal sector integration in EPR

In many countries, informal sector workers operate the e-waste collection, repair, refurbishment and recycling markets. In EPR schemes where the responsibility for overseeing collection and recycling has been delegated to PROs, integration with informal sector workers offers the advantage of knowing the origin of secondary raw materials and securing access to them. This can add additional value to a PRO operation [157] Informal e-waste collectors and recyclers have significant knowledge and access to e-waste that would otherwise be challenging for formal operators, fitting under the all-actors approach with access to e-waste. In Ghana, for example, it is estimated that the informal sector activities of the Agbogbloshie Scrapyard result in the treatment of approximately 39 per cent of the e-waste generated.[158]

Formal collaboration with informal e-waste collectors and recyclers can be established on a voluntary basis. DESCO Electronic Waste Recyclers in South Africa has been incorporating informal sector workers into its business model for several years, giving DESCO the advantage of outsourcing operations for wider reach whilst the informal sector operators retain independence and their own businesses.[159] But a strong political willingness and clear mandates for producers under EPR could further strengthen the integration contributions from informal sector operators in a meaningful and dignified way. The South Africa EPR-based e-waste regulation from 2021 sets obligations for PROs that establish and implement EPR schemes to integrate informal e-waste collectors, reclaimers and pickers into the post-consumer collection value chain. For producers that establish and implement their own scheme, obligations have been set to compensate informal e-waste collectors, reclaimers and pickers, who register with the National Registration Database, for collection services and environmental benefits, through the collection service fee by November 2022.[160] Support for, and integration with, the informal sector, can start simply by, among others, establishing co-working spaces,[161] providing PPE and simple equipment (for safe dismantling) or offering a bank account in return for e-waste being brought to a compliant recycler.

Free-riding online sellers

Nowadays consumers have much improved access to sellers of EEE based abroad. However, in many cases, these sellers do not comply with EPR regulations in the country where the product is being sold.[162] Although not all free riding is intentional. Consultees highlighted that multi-seller online platforms have a role to play in EPR by informing the sellers using their platforms that EPR obligations exist in some countries. According to Eurostat, from 2011 to 2020, the percentage of companies that provided online sales increased from 16 per cent to 22 per cent.[163] Turnover from online sales has also been increasing, boosted by an increase in online shopping during the COVID-19 pandemic, which inevitably caused an increase in cross-border sales. Free riding, in general,

impacts the EPR system because the fee is calculated based on the amount of EEE placed on the market in previous years. So if equipment is sold to consumers in a country partly or not at all accounted for by the EPR system, the whole system may become under-financed, especially if the proportion of online purchases increases.

Limited understanding of the EPR fee impact

Theoretically, the EPR fee paid by producers is designed to initiate upstream changes in manufacturing and design in order to reduce waste and environmental impact. Some consultees pointed out that any EPR system that merely pushes the price of product stewardship onto consumers rather than producers erases the price signal that genuine EPR is supposed to deliver. There is very little research into the cost impact for the consumer as a result of producers not internalizing e-waste management costs. For many governments the first question that arises about EPR concerns the potential increase in cost of ICT equipment, which impacts its uptake and use. In developing countries where taxes on ICT imports are low or even non-existent in order to lower the cost of consumption and increase ICT penetration rates, this first question inevitably takes centre stage. Little research has been conducted on the upstream effects of EPR beyond the design stage as far as the extraction of raw materials is concerned. Where material inputs for electronics are concerned, more research into the effects of EPR policy on the environmental and social decisions of raw material extraction companies is needed.

Patchwork of policy and regulation

Much regulation based on the EPR principle has been developed and implemented by governments and non-government organizations worldwide to prevent the growth and illegal movement of e-waste between nations and, hence, restrict the associated pollution.[164] The OECD estimates that there are over 400 EPR schemes across various sectors.[165] At the same time, the growth in EPR regulation over the past decade has been significant in emerging markets. For example, in Africa there are 13 countries with EPR regulation in place,[166] almost all of which have been established in the past decade. There are, however, diverse approaches to EPR across the world. The EU WEEE Directive provides a level of harmonization throughout the EU but remains broad in terms of transposition at the national level. In the United States and in Canada, e-waste regulation and EPR are designed and implemented at the state / province / territory level that leads to an array of different approaches within each country. EPR rose in popularity in the 1990s and more than 70 EPR laws were established in the United States between 1991 and 2011.[167]

EPR fees can be collected at the point of entry, similar to import duties, or at the point of sale, which is the preferred approach in Canada due to the challenges that arise from fee collection at importation given that the imported EEE then moves on to be sold in one or more provinces and territories. In addition, fees at the point of sale makes product tracking easier. The need for the harmonization of common EPR features in Canada, given the context of 14 different jurisdictions (10 provinces, 3 territories and 1 federal-level) potentially regulating EPR, is such that the Electronics Products Recycling Association[168] has appointed a Director of Harmonization within its organogram.

Colombia was one of the first countries in the Americas region to have adopted EPR regulation. Law 1672, established in 2013, focusses on the decentralization of EPR.[169] While required to operate within the remit of the national law, regional authorities are given the power to implement their own regulations. Central government remains responsible for training, research and technological development, aimed at the comprehensive management of e-waste. In some countries the producer responsibility component is only financial, such as in Germany. In Switzerland, producers have both a financial and an organizational responsibility. In Japan, there are two laws regulating e-waste. The Law for the Promotion of Effective Utilization of Resources[170] places responsibility on the producer, following an EPR approach. However, the Law for Recycling Specified Kinds of Home Appliances[171] places more emphasis on the role of the consumer concerning recycling.[172] Collectively, such laws reflect the many differences in the scope of products covered.

Consultations highlighted a tendency by policymakers to confuse the failures of the EPR concept with the challenges of regulating and enforcing e-waste management. Looking at the harmonization of EPR, rather than the concept, it appears that the definitions and obligations of e-waste regulation need to be harmonized, such as the scope, calculation methodologies, fee collection points and producer registration. It was also noted that the EPR concept would benefit from a list of essential ingredients that could be harmonized in EPR-based e-waste regulation.

New and varying modes of consumption

Overall growth in the consumption of EEE is accompanied by new methods of access to EEE. Individuals and corporations alike have been experimenting with the concepts of leasing, exchange, sharing and reusing, thus shifting to access-over-ownership and post-ownership models, and contributing to dematerialization (the "absolute or relative reduction in the quantity of materials used").[173] Philips Circular Lighting provides lighting as a service, allowing users to pay only for the light rather than for the equipment. Installation, performance and servicing of the lighting is taken care of by Philips Circular Lighting.[174] Getting the products back after use, means that producers can take care of the end-of-life management phase. Similar approaches exist in the IT sector, for example, by Dell, which provides PCs as a service.[175] Providing access by clients to a product rather than ownership of it ensures that Dell is in a position to responsibly retire EEE at the end of each service contract. However, from a regulatory perspective, it is unclear to

what extent voluntary actions (in particular offering products as a service) to minimize environmental impacts are incorporated into EPR; in particular the trend for EPR objectives to focus on boosting e-waste collection rates.

Consumers can access the latest technology without high up-front costs due to current leasing and rental models, such as monthly smartphone contracts.[176] In other sectors, the growth of platforms such as Third Home, Uber, Airbnb and BlaBlaCar have created new models of vehicle and accommodation access.[177] The Ellen MacArthur Foundation conducted a study focussing on smartphones, laptops, tablets and smart home devices, trying to understand what a circular economy for the consumer electronics industry could look like. The study noted that by dematerializing and transferring capabilities from consumer hardware to the cloud, the pace of hardware obsolescence can be reduced. Cloud computing, which the sharing economy model relies on for its data usage, can play an important role in prolonging the use of electronic devices.[178] It is vital that products as a service are kept in use for as long as possible to reduce the rate of hardware obsolescence and to keep the value in products for as long as possible.[179] No research has been conducted into the effect that EEE remaining in circulation longer has on e-waste collection targets, nor whether ambitious collection targets make electronics as a service less attractive as an environmentally sustainable business model.

Constantly changing electronics

Technological progress and digital innovation have allowed for the development of more efficient, useful, imaginative, and complex electronics. The complexity of integrated circuits for example has been doubling every two years more or less,[180] and the miniaturization of electronics has enabled communication technologies such as mobile telephones to become smaller and smarter. Pervasive or ubiquitous computing, by which computational capabilities are embedded into everyday products is also responsible for the growth and diversification of e-waste. From electric cars to connected watches, Wi-Fi compatible showers and smart toys, the nature of EEE is diversifying as the list of connected and electrified products grows. Technological innovation is inevitable and the way in which EEE will evolve cannot be controlled.[181] This creates complexity and uncertainty in future e-waste streams, meaning that regulators must monitor technological developments over time to ensure that all EEE remains in the scope of e-waste regulation, including in terms of EPR.

Weak harmonization of data

Monitoring flows and quantities of e-waste is crucial for e-waste collection and recycling targets and to evaluate progress over time. Countries are responsible for this data collection process and for the documentation of the challenges associated with e-waste management. Often, transparency becomes an issue when there exists a lack of capacity or willingness to compile data on formally collected and recycled e-waste. As mentioned previously, the rates of national reporting by Member States of the Basel Convention are low, and data provided on transboundary movement of hazardous and other wastes are aggregated, which makes it difficult to separate data on e-waste only. Furthermore, not all countries have a fully functioning EPR system where PROs and compliance schemes are coordinating EPR obligations and thus collecting data at the same time.

Who collects, the type of data collected and at which frequency are all factors that tend to differ across countries. The Global E-waste Statistics Partnership[182] aims to address the challenges associated with e-waste data collection by monitoring developments over time and providing capacity building to governments in the collection of harmonized data using an international methodology.[183] Data sharing is important globally to facilitate harmonization and enforcement. A number of regional harmonization initiatives are in place. For instance, the EACO Regional E-waste Data Harmonization project[184] by ITU and UNITAR, in collaboration with the East African Communications Organisation (EACO), aims to develop a harmonized approach to collecting e-waste in the region. Along with the harmonization of EPR definitions, harmonization in the methodology used to collect data on the amount of e-waste generated, collected and recycled, and the global tracking of these indicators, would be critical components of any international regime on this topic.

Lengthy law-making to enforcement timeline

The majority of the world's population (71%) is covered by an e-waste policy, legislation or regulation according to The Global E-waste Monitor 2020.[185] Environmental topics do not always fit squarely within the political agenda of countries, whilst change in political direction or leadership can expose the fragility associated with regulatory development around the management of e-waste. Consultees highlighted that the preparation of strategies, policies and laws governing e-waste management is not the main challenge. Rather, it is applying the right resources for the long-term commitment integral to seeing through implementation of such normative instruments. When such instruments are legally-binding and imply penalties and enforcement, or when they set out obligations for several stakeholders or where the custodian from government of such instruments is not clear, then the law-making timeline is likely to be more cumbersome. In the context of EPR-based e-waste regulation, timelines can be reduced if producers are engaged early on in the process so as to reduce surprises during implementation and enforcement. Through the e-waste policy programme being provided by ITU to several countries, it has been identified that kick-starting EPR implementation in parallel with law making is efficient. For example, by determining up-stream the appropriate EPR fee and registration platform including the necessary e-procedures.

Data security concerns

The collection and management of e-waste, which can contain private or personal data, raises challenges associated with data security for businesses and homes. A lack of understanding of data security can lead to abandoned EEE being stored at home or in office storage rooms. When consumers decide to discard EEE, and despite efforts to delete their data, private or personal information is often present and retrievable.[186] In order to encourage e-waste disposal, recycling companies, for example, could offer a data wiping and data destruction service, although any solutions offered in terms of removal of data would need to be both fully reliable and transparent. Today some companies offer guarantees that such action has been taken through the issuance of data sanitization certificates. Security standards apply in this context, requiring recyclers to respect processes such as Information Security Management systems (ISO 27001 and ISA 66399).[187] Additionally, ITU T SG5 is developing Recommendation ITU-T L.GPSIM[188] on good practices for the sanitization of information media in end-of-life ICT devices and Recommendation ITU-T L.ME_DD[189] on assessment of material efficiency of ICT network infrastructure goods (circular economy). Little research has been conducted on how data security concerns affect reuse and refurbishment. Stakeholders such as regulators, recyclers and PROs involved in e-waste management in developing countries must factor in processes to ensure data security on personal devices, considering the perceived high numbers of imported EEE in circulation.

Insufficient financing and compensation

There is a broad selection of financing models available to support e-waste management. At the same time, several types of costs are associated with e-waste management. These can include technical costs for operations such as collection, transportation, treatment and disposal.[190] Costs for awareness raising, auditing, enforcement and administrative purposes, such as staffing, can also be included in the overall cost. The different types of funding models can include an advanced recycling fee, general taxation or a compliance fee.[191] The advanced recycling fee is charged to the consumer at the point of sale, taxation involves the collection of a fee by the government (or an authorized body), and a compliance fee involves the payment of a fee by producers to a PRO that covers costs, such as those mentioned above.

Some countries face challenges with financing when EPR-based e-waste regulation is approved before there is any discussion (with relevant stakeholders) about the optimal financing model and appropriate fees based on cost. This creates challenges when EPR-based e-waste regulation (or associated implementation guidelines) fails to spell out what the optimal financing model entails for stakeholders, such as details on the applied financing mechanism, the frequency of EPR fee payments, who should be paying, where the payments should be made, what the flow of financing from one stakeholder to another looks like, the applicable penalties for non-compliance, and the methodology being used to calculate the fees.[192]

Financing is a sensitive matter as it is difficult to build consensus on the optimal financial model to adopt amongst stakeholders involved in e-waste management. This is especially the case among government authorities when selecting the right financing model also entails that the fee collector(s) and registerers of producers would have to assume more responsibility. Without an optimal EPR financing model to accompany e-waste regulation, there may be less momentum during implementation. In the off-grid solar industry, for example, building consensus on strategy and financing would also present challenges given the different product categories and their varying associated costs, business models and commercial sensitivities such as sales and take-back data.[193] As discussed, financing models can entail direct and indirect costs for producers that are mostly related to the collection and management of e-waste fractions with negative financial value. Recycling companies are motivated by incentives as profitability in the industry remains low with full compliance. Consumers too are motivated by incentives, of which several examples have been provided previously.

Closing considerations

Extended producer responsibility is a policy principle that can be strengthened by a regulatory framework to govern its implementation and enforcement. However, unless complementary actions are explored to support the collection of e-waste in all countries, regardless of the status of the e-waste management system, collection rates will continue to be outpaced by the amount of e-waste being generated. Complementary actions can be wide in scope, from commercially or not-for-profit driven to solution-based actions, including deposit-return or refund schemes, public-private-partnerships, as well as the all-actors-approach and the best-of-two worlds philosophy.

Countries globally are at various implementation levels when it comes to EPR-based e-waste regulation. It takes a long time to develop, approve, operationalize, enforce and monitor regulation. This can make countries slow to respond to the e-waste challenge. Complementary actions used to support the take-up of EPR-based e-waste regulation must achieve short-term impact and at the same time have the potential for continuity. It is clear that this should not just involve EEE producers, nor should it only involve the private sector. All relevant actors must play a role in the EPR system in order to successfully increase the collection of e-waste.

Increasing the number of countries covered by e-waste regulation is key to maintaining a level playing field and although EPR-based e-waste regulation is being developed, it must remain flexible in terms of integrating different complementary actions in the overall e-waste management system. Much can be learnt from other industries, in particular from the batteries, vehicles and plastics sectors.

There are significant teething issues globally when it comes to defining national EPR regulatory frameworks and to implementing the EPR principle for EEE nationally. Defining who the producers are, registering them and harmonizing this data on a global level is a major challenge. At the same time, too little attention under EPR is being paid to the implications of the movement of products across borders.

International standards, such as the ones mentioned in this paper, can play a critical role in setting the requirements and guidelines needed to implement a sustainable e-waste management system. International standards can provide best practices on all aspects, including treatment, collection, digital passports and data security in efforts to support sustainable e-waste management globally.

In order to make e-waste available for collection, stakeholders with access to e-waste must collaborate with one another, this includes retailers in particular. There is also a role to play by retailers and municipalities in making it convenient for consumers to drop off e-waste. At the same time, only a handful of examples exist of other actors, such as post offices and postal networks, playing a role in the reverse logistics of e-waste collection whilst at the same time boosting convenience.

Many of the challenges recognised in this paper are applicable globally but the lack of data makes it hard to determine the most appropriate policy interventions, in particular when it comes to ultimate producer responsibility and the information needed regarding the transboundary movement of second-hand EEE. The scale of the lack of data on EEE, such as who is transporting it, where it is being transported, who is buying or selling EEE and where it is being bought or sold, makes it impossible to fully comprehend where the responsibilities lie with a global approach to extended producer responsibility. Many complementary actions can operate across national borders, but these would benefit greatly from an international regime, with the objective of overseeing a global approach to tackling e-waste and of ensuring the harmonization of national EPR approaches.

An international regime, a global secretariat, a partnership structure, a global treaty or other UN initiative to cover several critical areas of e-waste management and related EPR approaches would reduce the current fragmentation of stakeholders in the electronics sector and increase open dialogue between governments and industry. Many global partnerships and coalitions exist for EEE as a whole, but each aims to address a niche area. Roadmaps, blueprints and global agendas exist but few permeate, from an operational standpoint, the local e-waste issues and universal EPR challenges. It will be important to build on the foundations of existing partnerships and coalitions to bring government and industry representation together to identify ways to implement and operationalize the universal calls to action.

End Notes

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