Task Force 3
LiFE, Resilience, and Values for Wellbeing

MAXIMISING RESOURCE EFFICIENCY AND CIRCULARITY IN THE ELECTRICAL AND ELECTRONIC EQUIPMENT VALUE CHAIN AND THE E-WASTE SECTOR

May 2023

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Abstract

Countries face various challenges in streamlining the management of e-waste, whose global volume reached an estimated 53.6 million metric tonnes (MT) in 2019. Primary of these challenges is lack of accurate data reporting. The untapped recovery of e-waste also results in huge financial losses. The Global E-Waste Monitor, 2020, calculated the valuation of materials that could be recovered from e-waste generated in 2019 alone at about US$57 billion. Effective management of electrical and electronic equipment (EEE) can help the G20 nations improve their environment and economy as well as meet several UN Sustainable Development Goals (SDGs). This Policy Brief provides recommendations to the G20 on policy instruments to decouple growth in the electronics sector from virgin resource consumption and environment degradation through improving resource efficiency, particularly in consumer EEE.

The Challenge

1

Resource consumption and procurement

From the lens of resource consumption, electrical and electronic equipment (EEE) are intricate devices that require multiple elements, including critical raw materials (CRM) such as indium, niobium, gallium, and dysprosium. According to the Global E-Waste Monitor, 2020, the demand for aluminium, iron, and copper for EEE production in 2019 was approximately 39 MT, while the amount of these elements in e-waste was only 25 MT, resulting in a gap of nearly 14 MT to be filled with virgin material (Forti et al. 2020). Since only 17.4 percent of total e-waste was recycled in 2019, the economic loss from these three elements alone was roughly US$34.5 billion, while the total valuation of materials in e-waste was approximately US$57 billion (Forti et al. 2020). The imperative is to shift resource demand for EEE towards sustainable consumption.

The limited global supply of CRMs inhibits procurement of raw materials integral for EEE production. The resources are concentrated in a few countries that control its supply. Currently, China produces 86 percent of the world's rare-earth metals (Wieringen and Álvarez 2022). Primary supply of critical materials being in the hands of a few nations has the potential to disrupt global supply chains. This was evident during the US-China trade war in 2011 as well as in the ongoing conflict between Russia and Ukraine. Securing supply of CRMs, such as from the untapped potential of e-waste, is essential for the G20 to reduce the burden on scarce, virgin raw materials and achieve resource efficiency (RE) and circularity in the EEE sector.

Design and technology

Modular designs, which allow for easy repairing and recyclability, are critical to improving circularity. However, the industry's linear business models often prioritise short-term profits over long-term sustainability. Currently, EEE are assembled in a way that makes disassembly and refurbishment difficult. Planned obsolescence is resource-intensive, perpetuating linear economy. It is a strategy adopted by manufacturers to shorten the lifespan of their products to maximise profits through selling newer products (Rivera and Lallmahomed 2016). The lack of a regulated lifespan for EEE results in reduced utilisation of electronics

as they are not fully reused, repaired, recovered, and reinserted into upstream production and development streams, thereby negatively impacting RE.

Major EEE manufacturers patent their technologies. Despite using similar raw materials for similar products, the design principles of each brand are unique, with limited technology transfer and knowledge-sharing, creating significant challenges for the use of e-waste and secondary raw materials (SRM).

E-waste management and monitoring global waste flows

The lack of global data on formally collected and recycled e-waste implies that 82.6 percent of e-waste was managed outside the official collection system in 2019 (Baldé et al. 2022). Unfortunately, many countries in South America, Asia, and Africa lack records and statistics on waste EEE (WEEE) transboundary movement, while national reporting is insufficient for comprehensive sectoral analysis. Incomplete reporting, ambiguous definitions, and incorrect categorisations result in uncoordinated global datasets that hamper monitoring efforts. These concerns favour illegal e-waste transportation and pose a threat to effective management under the Basel Convention. E-waste monitoring is especially challenging in nations where both formal and informal recycling sectors co-exist, as leakage to the informal sector can lead to the underutilisation of formal recycling and misreporting of data.

Overconsumption also poses a significant challenge for achieving sustainable e-waste management. The increasing purchasing power of individuals in G20 nations has led to the proliferation of consumer electronics, which are replaced within their designated lifespan due to changing trends or the introduction of newer technology. This has contributed to an increase in e-waste generation and thus, increased environmental impact. Consumers, unaware of their 'right-to-repair', seldom question the producers who make their products intricate and spare parts less available, making it harder and costlier to repair used electronics, thereby nudging consumers into forced overconsumption.

Legacy e-waste is not addressed in the current linear model of EEE management. It is often witnessed in developing countries that a significant fraction of obsolete electronics, such as old

mobile phones, are either stored within households or disposed improperly. Producers and manufacturers are repurchasing electronics in terms of market value rather than the value of SRM trapped within e-waste, which deters consumers from formally disposing their electronics. In terms of resource availability, a 2003 cell phone, Motorola T189, has nearly three times the gold concentration of a 2013 Google Nexus S smartphone (Singh et al. 2018; Chen et al. 2018).

Lack of synergy in policy implementation across the EEE value chain

The absence of coordinated efforts makes it challenging to establish a unified framework and have a consistent approach to track and monitor EEE production, consumption, e-waste generation, and global waste flows. Globally, there is a lack of shared responsibility framework for the EEE value chain, including e-waste, to promote RE and circularity.

Despite the Basel Convention aiming at regulating the movement of hazardous waste between nations, illegal shipments in the form of complex and multidirectional transboundary movement of e-waste remains a critical issue. Even for formal WEEE flows, there is little knowledge on downstream management in developing nations. For instance, Europe exports nearly 1.9 MT of e-waste to Africa, Southeast Asia, and Central America, with little accounting, if at all, for the type of recycling facilities, treatment measures, and other safe practices (Forti et al. 2020). Another shortcoming of the Basel Convention is that it categorises WEEE in two categories—hazardous and non-hazardous—instead of viewing it as a source of SRM, thereby disregarding the trapped resource potential in WEEE. Beyond the Basel Convention, there is a lack of clarity on the definition of EEE and a common consensus of what EEE entails. Different definitions for EEE and WEEE categories at the national and international levels make it difficult to quantify the magnitude of the problem, giving rise to different estimates for e-waste generation.

Extended Producer Responsibility (EPR) is a policy approach to enhance RE by making producers accountable for managing the post-consumer stages of their products (OECD 2016). Countries implement EPR depending on their own development trajectories. Germany

and Japan have well-established EPR systems with clear targets for collecting and recycling e-waste (Kaur, Atiq, and Gautam 2022). Canada, on the other hand, does not have an EPR regulation for WEEE at the national level, but has 10 distinct provincial rules for e-waste management (Portugaise, Jóhannsdóttir, and Murakami 2023). India has ratified its amended E-Waste Management Rules 2022, with newer collection targets, wider scope of EEE coverage within jurisdictions, and the introduction of e-waste credits (MoEFCC 2022).

Although EPR policy stresses on post-consumer collection of e-waste with the targets, treatment, and recovery of SRM, its uptake by producers in the upstream stages of design and production are yet to be addressed. Countries face EPR policy implementation challenges due to inadequate infrastructure, lack of public awareness, and weak regulatory frameworks. Different countries hold different stakeholders accountable for e-waste collection; Canada engages PROs, Japan holds retailers accountable, while India provides a mix of both. However, the absence of the key stakeholder, i.e., the informal sector, in India's e-waste legislation presents an implementation challenge since a majority of e-waste is handled informally. EPR policies, especially those in developing nations, should allow for the integration of informal and semi-formal sectors to strengthen the formal EEE and e-waste value chains.

Finally, a lack of harmonised standards in end-of-life EEE value chain makes it difficult to refurbish products while ensuring quality control. This poses a challenge to incorporate refurbished products into procurement policies. Without clear criteria for evaluating refurbished products, businesses may be hesitant to purchase them. Therefore, despite pushing policies like green procurement, the reach of refurbished electronics is limited.

The G20's Role

2

The top 10 e-waste generating countries in the world are all members of the G20. Therefore, G20 states must come together and assume a key role in transitioning away from the current resource-intensive linear economy to a more resource- and material-efficient circular economy. The G20 can contribute to achieving sustainable development in the EEE sector through the development and implementation of an integrative policy framework whereby stakeholders, both local and global, think in a collaborative, synergistic manner throughout the product's value chain to ensure resource security.

The current EEE sector is managed in a centralised manner, with only a few countries controlling the global supply of CRMs. In addition to raw material sourcing, EEE design and technology is dominated by a handful of electronic manufacturing giants, whereas its consumption is widespread. This has made way to tolerant policies leading to planned obsolescence and overconsumption. On a global level, various factors like the COVID-19 pandemic, geopolitical instability, skewed exploration of minerals, and illicit WEEE flows have disrupted the e-waste stream.

The G20 further plays a key role in bringing together stakeholders from across the EEE value chain to enable high-value resource recovery. Together, the member countries can put regulatory pressure, along with environmental and social concerns, to foster circularity while creating a market for sustainably manufactured and repaired goods. In most developing nations, this entails bridging the gap between the formal and the informal sector. Large-scale WEEE collection under EPR in developing nations can be implemented by integrating a robust door-to-door collection network established by informal waste collectors. Moreover, a commitment towards implementing CE-enabling policies, such as product-life extension, can allow informal refurbishing workers access to markets for secondary EEE.

As determined by the E-Waste Monitor, only about 17.4 percent of the total e-waste generated globally is recycled while the fate of the remaining 82.6 percent non-recycled e-waste is unclear (Forti et al. 2020). This presents an opportunity for the G20 to make e-waste data-collection (both formal and informal) mandatory and transparent to fully understand the magnitude of global e-waste flows. Such transparency will

allow for robust, data-driven decision-making. Data collection and tracking can allow for strategic benchmarking for countries, regions, as well as the private sector. Countries may set quantifiable targets and measure their success while improving their reporting on circular indicators and climate goals.

Lastly, the G20 can nudge consumers into making right choices and moving towards sustainable consumption. A key aspect of this includes making consumers aware of their right to products' life extension instead of being forced to upgrade their electronics. The G20 platform is key to further the global Lifestyle for Environment (LiFE) initiative launched at COP26. The LiFE initiative is also being taken up as part of India's G20 Presidency to create demand for sustainable products and mobilise communities towards climate-friendly actions.

Recommendations to the G20

3

To overcome the challenges discussed in this Policy Brief, the G20 should propose a common shared responsibility framework for transitioning to a circular economy for the EEE sector. The main policies of this framework are discussed in the following points:

1. **Enabling transparent trade and green procurement** across the G20 for SRM extraction from WEEE to mitigate global supply risks. Sustainable procurement of raw materials pursues 'value for money' in a life-cycle perspective by taking into account factors such as consumption of materials, repair, maintenance and utilisation, product lifetime, and end-of-life disposal costs. The Marrakech Task Forces can provide guidance on how to implement effective sustainable public procurement policies that reduce waste and increase RE (UNEP 2022). Globally, harmonised standards for certifying/assessing refurbished products are to be developed and incentivised through transparent trading and green procurement policies on a common trade platform for streamlined monitoring. This will curtail illegal transboundary movement of WEEE and enable trading under the Basel Convention to be more resource-efficient, since secondary products will be purchased upon their value of SRM composition.

2. **Co-develop mechanisms for digitally tracking material flows** including CRM and SRM to support stakeholders in achieving CE processes in the EEE sector. Digitalisation can minimise waste, enable more efficient processes, promote longer product life cycles, and reduce transaction costs. For example, digital products passport (DPP) can facilitate material tracking and recovery, while blockchain technology can increase transparency and traceability in supply chains (European Union 2020). DPP provides a standardised framework for collecting and sharing data related to raw material recovery and design across value chains (Koppelaar et al. 2023). The ProSUM study undertaken in the EU can be replicated across regions for

baselining the material flows. This will also resolve the issue of legacy e-waste. Digital technologies such as IoT sensors and RFID tags can be used to track and monitor material flows by providing real-time data to stakeholders and allowing better decision-making on material recovery and recycling (Chauhan, Parida, and Dhir 2022). Digital mechanisms can promote eco-innovation as well as digital tracking and monitoring, which are crucial for achieving a sustainable global circular economy.

3. **Co-develop eco-design guidelines and CE indicators** for the EEE sector to enable harmonised trade, increase RE, and address the issue of planned obsolescence. CE indicators can include metrics such as proportion of recycled material used in production, energy efficiency, and waste generation per product. Through these indicators, manufacturers can track their progress towards circularity and consumers can make informed choices.

   For example, the EU has established a set of CE indicators to track progress. Currently, materials as well as their composition vary with companies. Standardised guidelines mandate manufacturers to adopt sustainability in the design phase through incorporating circularity principles in product design. For example, in consumer electronics, accessories such as chargers must be modular/uniform across the category in order to reduce redundancy.

   This follows into the next recommendation on right-to-repair as consumers should have access to the information and parts needed to repair their products. This not only empowers consumers but also promotes circularity by extending product life. To overcome planned obsolescence and provide right-to-repair, regulations must mandate easily repairable and longer lifespans of products. For example, major manufacturers can be incentivised to share technology and knowledge with recyclers, enabling them to extract valuable materials more efficiently, with the motive of improving urban mining globally. Tech companies can also provide data analytics

tools to help recyclers identify valuable materials in e-waste as well as improve supply-chain transparency in collaboration with governments, private companies, and NGOs. The G20 can implement measures such as enforcing regulations mandating manufacturers to provide toolkits for repairing products and providing refurbished products supported by product standards and certification schemes.

4. **Global support for integrating the informal sector** among developing G20 members is key and can be achieved by establishing clusters/parks as well as micro-factories to promote decentralised high-value recycling. This promotes the integration of informal and semi-formal workers into formal EEE channels for better transparency. The G20 can ensure that appropriate policies and regulations are put in place to support this effort. Second, regions like Japan and the EU, with well-established WEEE infrastructures, should share their knowledge, infrastructure, and expertise to help developing countries manage e-waste in a sustainable and efficient manner. This would help the informal sector in developing countries use advanced technologies for high-value resource recovery.

5. **Financial support** in the form of a credit system for incentivising refurbished products at the G20 level is required. Producers can be encouraged to produce and use refurbished products by offering sustainable consumption credits. These credits can be earned by utilising sustainable, secondary raw materials and can be used to offset tax liabilities. This strategy reduces the cost of products, providing competitive advantage. The G20 can promote the exchange of refurbished products among countries by creating a global trade platform. Countries can earn trade credits by exporting refurbished products, similar to carbon credits, leading to a CE where products are repurposed and reused.

   The presence of a global refurbished product market can incentivise countries to invest in

refurbishing infrastructure. The G20 nations are key to promoting refurbished product exchange and encouraging sustainable production practices (OECD and UNDP 2019). Other financial incentives include common green bonds across nations. An example of this is the EU Green Deal, which proposes a 'circular electronics initiative' that includes financing measures for refurbishment and repair (European Commission 2020). Material taxation is another financial mechanism which can be utilised to incentivise RE (OECD 2016). Additionally, countries can opt for advanced disposal/recycling fee (ADF/ARF) in collaboration with local bodies to ensure formal channelisation of e-waste from consumers. The ADF/ARF can be implemented to take e-waste back to expand global deposits that allow consumers to return WEEE bought in other countries. Mechanisms such as digital deposit receipts and refunds can prevent illegal waste imports from non-deposit countries and link deposit data to the manufacturer's warranty, if the product has one.

6. **International cooperation and coordination** is required to accelerate the transition towards RE and CE. The G20 can spearhead efforts to lead this transition, but for its effective implementation, it is crucial to establish an agency or task force. The International Telecommunications Union (ITU) has a broad portfolio of activities in the area of e-waste and tackle the challenges at global, regional, and national levels, highlighting policy and regulatory gaps. The ITU could act as the head of the EEE global task force, which may comprise different institutions such as UNU, UNITAR, OECD, and ISWA, as well as the regional and national presence of ministries, along with research organisations and think-tanks working in similar areas. Such a task force would complement the Basel Convention in regulating and monitoring WEEE movement across borders and help in the uptake of projects pertaining to tracking EEE flows. Additionally, this enables the development of global strategies that guide local and national governance for the EEE sector decision-making. Having members from different

regions and administrative backgrounds would allow for the sharing of best practices and expertise, as well as for the development of joint initiatives and programs that would further guide and align individual country efforts and foster international cooperation among the G20 members.

Attribution: Abdullah Atiq et al., “Maximising Resource Efficiency and Circularity in the Electrical and Electronic Equipment Value Chain and the E-Waste Sector,” *T20 Policy Brief*, May 2023.

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