transform together

The 2030 Initiative for Sustainable Consumption and Production

Creating sustainable smartphones: Scaling up best practice to achieve SDG 12

SUSTAINABLE DEVELOPMENT GOALS

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

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About Transform Together and Sustainable Smartphones Working Group

Transform Together is a multi-stakeholder partnership that brings together stakeholders to promote sustainable consumption and production in high impact countries to help deliver the Sustainable Development Goals, most specifically Goal 12, Sustainable Consumption and Production. Transform Together does this by identifying, sharing and advocating - through existing networks and policy processes – the identified scaleable SCP practices.

In 2016, Transform Together created the Sustainable Smartphones Working Group (SSWG) consisting of representatives from business, civil society organisations and government in order to apply this theory of change to enable SCP for Smartphones.

Find out more: http://transform-together.weebly.com/

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Bioregional

SYKE
Finnish Environment Institute

Ympäristöministeriö
Miljöministeriet
Ministry of the Environment

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Summary

Transform Together is a multi-stakeholder partnership initiative created to support the United Nations' 2030 Agenda for Sustainable Development with a focus on Sustainable Development Goal (SDG) 12, Sustainable Consumption and Production (SCP), in high-impact countries. It was launched at United Nations Environment Assembly (UNEA) in 2016 and selected consumer goods as its first priority. Transform Together decided to focus on smartphones, one of the most widely used consumer goods, and established the Sustainable Smartphones Working Group. This consists of expert representatives from governments, business, academia and research organisations as well as civil society organisations.

This report outlines the work done by the Working Group so far; it distils the key areas of concern and leading practice across the smartphone life cycle covering design, raw materials, production, use, product life extension and end-of-life. Deriving from this analysis, it proposes practical and replicable key recommendations for governments, industry and consumers to accelerate the transition towards more sustainable consumption and production patterns for smartphones. The Ministry of the Environment of Finland and Bioregional funded the convening of the Working Group, writing this report and the research behind it.

Smartphones and the mobile phone industry as a whole have great potential to drive sustainable development forward through the use of smartphone applications and other mobile enabled technologies, that encourage sustainable consumption patterns and practices. However, the increased global consumption of smartphones combined with short product lifetimes also have negative environmental and social consequences. These negative social and environmental impacts include:

- Poor working conditions in the smartphone supply chain
- Use of high-risk and conflict minerals
- Accumulation of electronic waste
- Use of hazardous substances and intensive use of energy and other natural resources in the production process.

All of these need to be addressed urgently in order to enable truly sustainable production and consumption of smartphones.

Tackling these concerns requires acknowledgement, action and collaboration from governments, industry, consumers and institutional buyers and public procurers. After gathering and analysing of leading practice examples which address these areas of concern, the Working Group has set out key recommendations for governments, industry and consumers shown on pages 30-32. The detailed analysis behind the key recommendations and case studies are presented in the main body of the report starting from page 5.

This report serves as a starting point for collaborative action to accelerate the transition towards more sustainable smartphone production and consumption. We invite governments, policymakers, industry, civil society organisations, researchers and consumers to work together to find ways to act on the findings of this report, for example by knowledge transfer, by implementing the replicable examples and through collaborative projects, trials, pilots and awareness campaigns.

This report will be submitted to policy processes such as the 2018 European Commission review on how smartphones could be included in the Ecodesign directive. We welcome enquiries from interested parties who would like to find out more and join us in this endeavour. Meetings and events are planned in Europe in the spring/summer and the findings will be shared at the United Nations High Level Political Forum in New York in July 2018.

Introduction

Transform Together is a multi-stakeholder partnership initiative created to support the UN's 2030 Agenda for Sustainable Development with a focus on Sustainable Development Goal (SDG) 12, Sustainable Consumption and Production (SCP). It was established by sustainablity organisation Bioregional, and the leadership of the Beyond 2015 network. Bioregional act as the secretariat for Transform Together.

Transform Together works to enhance and catalyse the political, business and societal changes needed to achieve sustainable consumption and production by identifying and promoting positive and replicable examples of sustainable consumption and production. The unique approach of Transform Together is to convene experts to identify replicable policies and practices for SCP and advocate for these through existing networks and policy processes in order to more rapidly scale SCP in the mainstream of our economies.

Transform Together selected consumer goods as its first thematic priority and created a Working Group that focuses on **sustainable smartphones.** Consisting of experts from governments, business, academia and research organisations and civil society organisations, it aims to reduce the negative environmental and social impacts of smartphone consumption and production patterns by:

- Researching the sustainability aspects of production and consumption of smartphones;
- Outlining the key areas of concern within the smartphone lifecycle;
- Finding best practices from industry, policy and consumer perspective;
- Defining priority actions for industry, governments and civil society organisations and
- Approaching the relevant stakeholders to advocate the priority actions.

This document outlines the key areas of concern and best practices within the smartphone life-cycle identified by the Working Group and suggests recommendations for practical and replicable priority actions for goverments, industry and civil society. Implementing these recommendations has the potential to enable a rapid shift towards more sustainable consumption and production patterns for smartphones.

Why smartphones?

Smartphones are among the most widely used consumer goods. By 2018, just over 36% of the world's population is projected to use a smartphone - an estimated total of 2.5 bn.[1]

Smartphones and mobile communications technology have great potential to drive sustainable development forward through the use of smartphone applications and other mobile enabled technologies[2] that encourage sustainable consumption patterns and practices such as sharing, reducing waste, improving energy or resource efficiency or enabling sustainable farming practices.[3]

However, the increased production and consumption of smartphones, like any consumer goods, also have major social and environmental impacts. At the mining and manufacturing stages, the production of smartphones can be associated with environmental pollution, human rights violations, child labour and hazardous working and living conditions putting at risk the health and life of workers and their communities. At the other end of the life cycle of smartphones, the lack of Ecodesign[i], rising overconsumption and poor levels of repair, reuse and recycling create an increasing amount of electronic waste which is harmful to people and the planet.

Smartphones become bigger, faster and overall more powerful machines with every subsequent generation. As increasing demand and competition between smartphone manufacturers pushes the technical development of smartphones further the negative sustainability impacts are amplified with more materials and energy required in their production.

Some of these issues outlined apply to the mobile phone industry and the wider consumer electronics industry as a whole, but our report focusses on smartphones because their share of the global mobile phone market is continuously increasing,[4] accompanied by growing sustainability concerns.

[i] Ecodesign is an approach to designing products with special consideration for the environmental impacts of the product throughout its entire lifecycle.

Approach and the key focus areas

Our approach to identifying the areas of concern was based on gathering the latest evidence on the most pressing environmental and social impacts of smartphone production and consumption from a life cycle perspective. The analysis is based on smartphone carbon footprint and life-cycle analysis (LCA) studies[5], a hotspot analysis of the mobile phone lifecycle[6] as well as input from Working Group members.

We acknowledge that there are some other areas of environmental and social concern[ii] related to smartphone production and consumption that are not addressed in this report. Our focus has been on those areas in which the most direct sustainability impacts arise, as shown by the evidence gathered and as identified by the Working Group experts.

Combined with the analysis on the key areas of concern, the Working Group has also identified best practices and case studies from industry, policy and consumer perspective. The best practice examples in this document are focussed on real-life case studies which, if scaled up and replicated, could have a significant potential in shifting smartphone production and consumption towards more sustainable patterns. Six key focus areas were identified using these two approaches; **design, raw materials, production, procurement and use, product life extension and end-of-life**.

The sources used in this document consist of peer-reviewed scientific articles, publicly available information such as corporate communications and CSR reports, media coverage as well as personal communications from Working Group members.

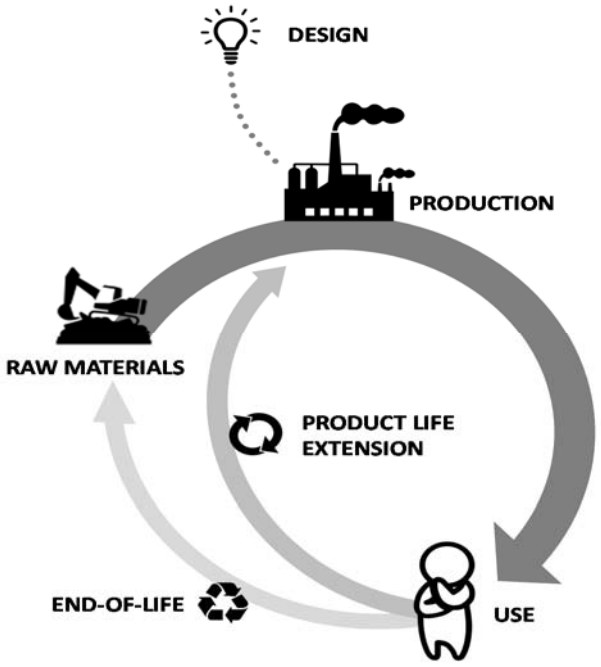


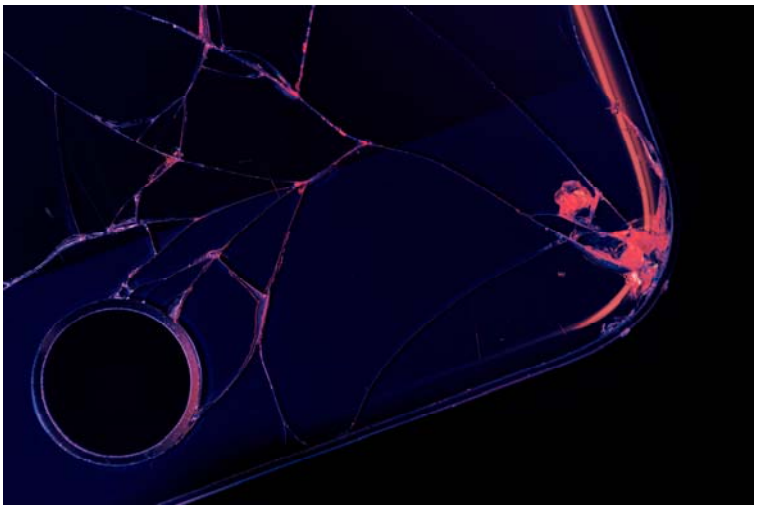
Figure 1: Smartphone lifecycle. Jáchym Judl, 2017.

[ii] Examples of impacts not addressed in this document include for example social and wellbeing implications of excessive smartphone use and health impacts of exposure to radiofrequency fields from mobile phones and base stations.

Design

The design phase is the overarching step that plays a crucial role in achieving greater sustainability of any product or service. Research shows that the design phase may determine as much as 80% of the environmental impact of a product with important choices affecting environmental, social and economic sustainability being made.[6] These include, but are not limited to, the selection of materials, decisions on the computing power of the devices and subsequently on the type of components[iii] used, reparability or replaceability of components and the recyclability of materials.

Concerns



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Currently the vast majority of smartphones are not designed to be easily repairable. Even batteries are typically not easily replaceable. Devices repaired by using non-OEM (Original Equipment Manufacturer) parts in some cases might not work properly and unauthorised service points are sometimes denied the access to them.[7] There are also concerns about 'planned obsolescence'[8], which means intentionally designing a product, its components or software in the way that shortens the product lifespan. The responsibility for minimising the risks of rapid obsolescence, planned or otherwise, lies not only with the smartphone producers but also the producers of the components and software and this requires collaboration across the whole supply chain.

The current trend in smartphone body design is towards the use of high-grade materials instead of once commonly-used, plastics. That creates an increased demand for metals such as aluminium, stainless steel or even titanium. In addition, specialty ceramics and toughened glass are increasingly being used. As verified almost two decades ago, PC/ABS[iv] and PP[v] shells cause up to ten times lower climate impacts compared to aluminium or titanium mainly due to the differences in energy consumption in making these materials. Newer generations of smartphones cause greater environmental impacts due to larger screens and more advanced chips.[7]

[iii] As an example, more functions require more integrated circuits (ICs), which have the biggest Climate Warming Potential (GWP) in smartphone production according to the Lifecycle Assessment of the Fairphone 2.
[iv] Polycarbonate/Acrylonitrile Butadiene Styrene.
[v] Polypropylene.

Due to their complexity,
smartphones contain a wide variety of materials, often speciality metals. End-of-life smartphones can therefore be great source of high value secondary materials if designed for easy disassembly and recycling. However, once smartphones are mixed with other waste electronic and electrical equipment (WEEE), recovery of some of these materials becomes a greater challenge. Although phone manufacturers have started using more secondary materials in their products, the recycled content of smartphones, and particularly of high-grade materials, remains relatively low.[9]

Best practices

Policy:

- Extend the EU Ecodesign Directive product criteria and relevant regulation in other jurisdictions (such as Energy Star in the US) to cover smartphones. Extend the criteria to cover resource efficiency in addition to energy efficiency.

Industry:

- Application of Ecodesign, and Design for Environment (DfE) principles including designing for reuse, easy reparability, remanufacturing, upgradeability, take-back, recyclability, avoiding any dependency on harmful substances and critical raw materials, conflict- and high-risk minerals.

- Selection of build materials and electronics hardware bearing in mind both intended use of the devices and the possibility for future software updates.

- Maximise the use of recycled and recyclable materials or bio-based materials which do not conflict with food chains.

- Optimised packaging, use of recycled, recyclable and renewable materials in packaging.

- Exclusion of unnecessary accessories, such as cables, low quality headsets and chargers or making them optional at purchase.

Case studies

Designing for Environment

Many smartphone manufacturers have taken action to include environmental and sustainability principles and criteria into their design processes. Examples from the world's biggest smartphone brand companies such as Huawei, Apple, Samsung, LG and Sony Mobile show that these may include requirements for use of recycled materials, circular design, better energy performance, resource efficiency and reduced use of heavy metals and hazardous substances. However, the companies often do not disclose specifics of the sustainability criteria and principles they use. There is a lack of transparency across the board in terms of how these criteria/metrics are manifested in the final products, how widely they are actually used across the manufacturer's product portfolios and how they have improved over the years in comparison with older product portfolios.

In contrast, Fairphone has a mission to design a smartphone that would incorporate Design for Environment in the core of its business model. Whilst Fairphone's market share has remained small (its products are only sold in Europe and often sold out due to limited production capacity), it has lead by example on issues such as transparency, product life extension, working conditions across the supply chain and greater use of recycled materials.

Modular smartphone design

The concept of modular smartphones has received a lot of attention over the years, but none have made it to large scale mass production. Modular smartphones offer the possibility of replacing dysfunctional modules, rather than the whole phone, as well as the possibility to update, upgrade or expand the phone and its features. Fairphone, PuzzlePhone (not launched) and formerly Google's project ARA or ZTE's modular phone (development of both discontinued) are examples of modular smartphone models. However, there are challenges related to modular design. For example, the modular phones designed to date are larger in mass and volume due to the need to house different components, which might be a barrier for some consumers and also requires more materials to produce. They also appear to have a higher material impact in the production phase compared to conventional smartphones in order to accommodate modularity, which needs to be balanced by a significantly longer lifecycle. Achieving a longer product lifecycle in turn depends heavily on the business model for the product and consumer behaviour.[10]

However, the Circular Strategies Framework for consumer electronics created by the Ellen MacArthur Foundation suggests that to achieve highest efficiency in terms of material recovery and cost savings, smartphones do not necessarily need to be fully modular, but should be designed to be at least partially modular. In practice this means that the printed circuit boards (PCBs), screens, batteries and shells should be easy and rapid to separate. Furthermore, the recyclability study performed by Fairphone shows how easy dismantling, as a pre-process to recycling, can help to recover a wider array of materials with lower environmental impacts, as it gives more flexibility to use different recycling routes for different modules.

Ecodesign policy

The product specific criteria of the EU Ecodesign Directive do not currently include smartphones. However, smartphones are included in the Ecodesign Working Plan for 2016-2019 through the ongoing work of the European Commission (EC) ICT Task Force, which is specifically looking to extend the criteria to certain categories of ICT products such as gateways, mobile phones and smartphones as well as base stations[vi]. Due to the pace of change in the fast-moving ICT product sectors, it has been difficult to estimate the energy saving potential of these product categories. The EC ICT Task Force is investigating which policy instruments including Ecodesign and energy labelling would be most suitable to address the energy and resource efficiency aspects of these product categories.

[vi] Mobile phone base stations are radio transmitters, through which radio waves are launched into the area, or cell, around the base station.

Raw materials

Smartphones are changing with every subsequent generation, not only in terms of their computational power but also in size and the materials they are made of. Continuing advances in microcircuitry, breakthroughs in material science and changing consumer preferences drive innovation at enormous speed. All of this defines the raw materials needed to produce the devices.

Concerns

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Smartphones contain a wide variety of materials, often speciality metals. Of the 17 rare earth metals, 16 are included in smartphones and none are currently recovered.[11] Extraction of some of these materials takes place in other parts of the world (such as Africa) than the production of the devices (Asia) or their use (Asia, Americas, Europe). Furthermore, smartphones along with other electronic devices, may require so-called conflict minerals (also referred to as 3TG = tungsten, tantalum, tin, and gold). In politically unstable areas where ores of these metals are found, sales can be used to finance armed groups, fuel forced labour and other human rights abuses, and support corruption and money laundering.[12] Cobalt, while not included in the 3TG definition, is also of concern. Used in the production of lithium batteries for smartphones and other devices, the human rights and safety risks of its extraction are widely documented.[13]

Mining of any raw material causes pollution and habitat destruction and often involves poor working conditions. Key environmental challenges are often related to large-scale water consumption (for ore processing) and pollution (long-term leakage of toxic leachate from slag), landscape damage and the loss of biodiversity caused by open pit mining and spoil dumping. The impacts of mining are greater in countries with weak or non-existent environmental protection legislation and law enforcement.

Social challenges are related to the working conditions in mines and often occur in the first step of ore processing. In some cases there is a lack of labour rights, low (or no) level of protective aids, and even life-threatening conditions (due to health and safety issues from mining, or societal instability or conflict in the region).

Transporting raw materials to locations where they are processed, and then to places where smartphones are manufactured, causes further environmental impacts including greenhouse gas emissions.

Best practices

Policy

- Comprehensive regulation on critical raw materials (CRM), conflict minerals (3TG) and high-risk[vii] minerals beyond 3GT such as copper, cobalt and lithium as well as a compliance monitoring system in place. Incentives for industry to go beyond compliance.

Industry

- Maximising the share of recycled materials in smartphones.
- Responsible sourcing of critical raw materials (CRM), conflict minerals (3TG) as well as high-risk minerals beyond 3GT such as copper, cobalt and lithium. Integrating responsible sources into supply chains that go beyond risk management and support social and environmental development for the miners and surrounding communities.
- Full disclosure of the details of the materials[viii] used in smartphones and the use of secondary materials or closed loop materials recovered through company take-back programs.
- Full disclosure of smelter list for all minerals, including information on due diligence efforts and compliance with third party assessment.
- Fully phasing out substances that are harmful to humans or the environment.
- Active involvement in industry initiatives for responsible sourcing of minerals and mining that have a measurable impact.

Case studies

Responsible sourcing of materials

Many of the big phone manufacturers indicate that they are moving towards more circular systems in sourcing their materials by using some recycled or recovered materials in their products, although none of them do it at very large scale. Moreover, for most manufacturers, the secondary materials use is limited to plastic. However, Fairphone also reports using recycled copper and tungsten in its devices and has implemented an evaluation of 38 material supply chains based on social and environmental indicators, including indicators on recycling rates and depletion rates, to select priority materials for improved recycling as well as mining. Apple reports that it has made risk assessments across 44 elements in its products, identifying aluminium, tin, and cobalt as priority materials for developing a supply of secondary sources of materials.[9]

[vii] At a minimum, this should include risks arising from conflict, forced labour, and extreme environmental impacts such as biodiversity loss as a result from mining.
[viii] Smartphones can contain hundreds of combinations of materials and therefore it would not be possible to disclose all combinations. However, the elements used in these combinations should be disclosed as minimum.

Despite some progress made in closing the loop on smartphone materials, all manufacturers are at least partially reliant on virgin materials, many of which are considered as conflict or high-risk minerals. Whilst most major smartphone manufacturers have a policy for conflict minerals, Fairphone has been the forerunner in supply chain transparency and due-diligence in this arena. For example, it sources Fairtrade-certified gold for its phones. Apple and Fairphone have both extended their supply chain due-diligence programmes beyond 3TG to include cobalt in an effort to resolve forced labour and child labour issues.[9] Huawei, Samsung, Sony and Apple are members of the Responsible Cobalt Initiative (RCI), an initiative of the Chinese Chamber of Commerce of Metals, Minerals and Chemicals Importers & Exporters (CCCMC), which is driving the supply chain due diligence system and standards for cobalt.

Responsible mining initiatives and industry practices:

The Alliance for Responsible Mining (ARM) is a leading global expert on artisanal and small-scale mining working with the sector on sustainable transformation. Fairmined is an assurance label developed by ARM that certifies gold from empowered, responsible artisanal and small-scale mining organizations who meet world leading standards for responsible practices.

The Responsible Minerals Initiative (RMI) is focussed on driving responsible sourcing of minerals. It offers a third-party assurance process and access to a database of audited smelters and refineries, reporting guidance and training to its members.

The Initiative for Responsible Mining Assurance (IRMA) is a multi-sector initiative that has established a best-practice standard and third-party independent assurance system to improve the social and environmental performance of industrial mining. The assurance system will launch in 2018.

Towards Sustainable Mining, an initiative of the Canadian Mining Association, is an example of a national responsible mining initiative. It includes tools and indicators to drive performance and ensure that key mining risks are managed responsibly at the facilities of association members. The Finnish Network for Sustainable Mining follows the Canadian example and has published its own standard.

The Fairtrade Foundation provides certification for gold mines. The Fairtrade Gold Standard includes strict requirements on guaranteed price, working conditions, health and safety, handling chemicals, women's rights, child labour and protection of the environment.

The Better Sourcing Program provides a technology-based communications solution that helps partners discover and leverage opportunities in the artisanal and small-scale mining sector, meet international responsible sourcing expectations and comply with conflict minerals regulations by delivering upstream supply chain due diligence.

ITSCI Programme, which is a joint industry membership programme between the T.I.C. and the International Tin Association, assists companies with due diligence and responsible sourcing of minerals from high risk areas.

Regulation and guidance on critical raw materials and conflict minerals

The OECD has produced detailed Due Diligence guidance and recommendations regarding conflict and high-risk minerals.

In the EU, the new Conflict Minerals Regulation will come into force in 2021. The regulation will help to ensure that the EU importers of 3TG as well as global and EU smelters and refiners will meet the international responsible sourcing standards set by OECD. The regulation is designed to help break the link between conflict and the illegal exploitation of minerals and to put an end to the exploitation and abuse of local communities, including mine workers, and support local development. However, the regulation has been criticised for its limited scope as well as the delay in its implementation. The main criticism is that the regulation only directly concerns importers of raw materials, and not importers of products with minerals in them. Furthermore, it does not include cobalt, copper and lithium, which are also considered high-risk minerals.

In the US similar regulation is already in place; Clause 1502 of the Dodd-Frank act requires companies to disclose where they source 3TG minerals. However, an Act including a repeal of Clause 1502 was passed in the House of Representatives in June 2017, pending review in the Senate.

The EU has published lists of critical raw materials (CRM) since 2011 which are aimed at encouraging sustainable management and efficient use and recycling of these materials. The latest list was published in 2017 and includes minerals used in smartphone production such as tantalum, tungsten and cobalt. The EU has also published a Commission Staff Working Document on Critical Raw Materials and the Circular Economy which looks into best practice in sourcing critical raw materials from the circular economy perspective.

Phasing out hazardous substances

The EU's RoHS directive (restricting the use of hazardous substances in electrical and electronic equipment), its REACH regulation (Registration, Evaluation, Authorisation and Restriction of Chemicals) and the US Toxic Substances Control Act are examples of regulations that require companies operating in or importing into these markets to restrict or altogether phase out substances classified as harmful or hazardous. Some smartphone manufacturers have gone beyond these regulations and started restricting the use of substances that have not yet been banned but the use of which is likely to become restricted. For example, Apple and Samsung have completely eliminated brominated flame retardants (BFRs) and PVC from all of their mobile phone models, and Sony from its Xperia phones. Fairphone is also PVC free. Huawei has indicated that it is restricting the use of these substances in its products, however the scale of these restrictions is unclear.[9]

TCO Certified, a sustainability certification for IT products, has also introduced criteria aimed at identifying safer alternatives to largely phased-out halogenated flame retardants. All flame retardants included in certified products must be independently verified and benchmarked as safer alternatives, in accordance with the Green Screen for Safer Chemicals hazard assessment framework.

Production

Smartphones contain sophisticated components such as processors, memory chips, touch screens, high power batteries and a wide range of sensors. A typical smartphone is made of hundreds of components, many of which are extremely small. The majority of smartphones are produced in Asia, mainly in China (Apple, Nokia, Xiaomi, Huawei and many others), Vietnam and South Korea (Samsung), Japan (Sony), India (LG), or Taiwan (HTC).[14] In addition to these countries, the smartphone production supply chain extends to countries such as the Philippines, Indonesia, Malaysia and Brazil. The majority of smartphones are manufactured by a small number of major companies, including Foxconn, Jabil, Flex, Sanmina, Celestica and LeEco.

Concerns

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Poor working conditions in factories producing mass-market smartphones and smartphone components have been an ongoing issue.[15] Occupational risk hazards particularly caused by exposure to harmful chemicals, work overload, low wages and long working hours are the major labour-related concerns in these factories. In the past there have been even some allegations of the use of child labour in some of these factories.[16]

The quality of working conditions and the severity of environmental impacts vary depending on the position within the supply chain. In general, the further away suppliers are from the brand name companies the worse conditions workers often must endure. The electronics industry's organisational structure with its highly fragmented supply chains and uneven trading conditions contributes to these problems. Worker empowerment and representation are key to ensuring a long-term, sustained positive impact on working conditions.

Due to the short life-spans of smartphones, their ever-increasing complexity and computing power, the growth in display and device size and the use of high-grade materials, the environmental impacts of smartphone manufacturing are rising. Production of electronics, especially the electronic components such as integrated circuits (IC), printed wiring boards (PWB), batteries and displays, is very energy intensive. Electricity supply in the countries where electronics are made tends to rely heavily on fossil fuels including coal, causing high carbon emissions and air pollution.

Water consumption, including ultrapure water used in the production of smartphone components, is very high because of the many cleaning and rinsing phases required. Furthermore, many hazardous materials are used in the production of smartphones

which result in toxic wastewater
that is not always appropriately treated causing eutrophication and pollution of waterways.[6]

Best practices

Policy

- Form partnerships through international collaboration and trade agreements to promote and endorse the International Labour Organization's fundamental conventions on: freedom of association and the right to collective bargaining (e.g. forming trade unions); getting rid of all forms of forced or compulsory labour; abolishing child labour and ending discrimination in the workplace.

Industry

- Comprehensive and transparent supplier engagement programmes in place that go beyond standard supplier audit schemes and are dedicated to improving working conditions and environmental sustainability in the supply chain.

- Involvement in and development of industry-wide multi-stakeholder programmes that are dedicated to improving working conditions and environmental sustainability in the supply chain.

- Publishing the names and production locations of the full supply chain as well as the performance of the component manufacturers on key labour issues.

Case studies

Environmental and social sustainability in the smartphone production supply chain

Fairphone has set improving working conditions of its manufacturer suppliers as one of its core commitments. It works closely with its top-tier suppliers (case makers and final assembly partner) to assess and improve working conditions in its supply chain. It has also set up specific programmes with ten of its suppliers that focus on improving environmental and social impacts of Fairphone manufacturing.[6]

The majority of the smartphone manufacturers have a supplier management and audit programmes in place but their efforts in this area vary. Many of the big manufacturers are part of the Responsible Business Alliance (formerly Electronic Industry Citizenship Coalition), which requires its members to adhere to its Code of Conduct setting standards on social, ethical and environmental issues.

Several smart phone companies are also part of the Clean Electronics Production Network (CEPN) together with academic institutions and labour rights organisations. CEPN's goal is to move toward zero exposure of workers to toxic chemicals in the electronics manufacturing process.[9]

Renewable energy in the supply chain

Apple is the only smartphone company which has made a renewable energy commitment for both its own operations and its supply chain. The company has a 2020 goal to deploy 4 GW of renewable energy in its supply chain, with so far almost 3 GW achieved. Apple itself has so far deployed nearly 500MW of solar and wind-

powered generating capacity in China, and has made significant progress with its suppliers as well.[9]

For example, iPhone parts maker Jabil, with Apple's support, has committed to running its entire Apple-related operations in China on renewable energy by 2018. To make sure the measures required to achieve this were in place Apple and Jabil met jointly with the municipalities of Chengdu and Wuxi to shape policy changes that made it possible for Jabil to source clean power directly through power purchase agreements (PPA) with local renewable energy projects, primarily those involving wind farms. The policy changes were required as it is still relatively unusual in China to have PPAs which involve private corporations as energy buyers.[17]

International collaboration on promoting fundamental labour rights practices

Although not specifically linked to electronics industry, the Initiative to Promote Fundamental Labour Rights and Practices in Myanmar agreed between the governments of Myanmar, the United States, Japan, Denmark, the European Union and the International Labour Organisation is an example of international collaboration aiming to strengthen the legislative and policy framework at a fundamental level to ensure better labour standards in developing countries.

Trade Union Networks (TUNs) and Global Framework Agreements (GFAs) have enabled global trade unions to support local unions in supply chains of such companies as IBM, Siemens India and Electrolux in producer countries in Asia, Latin America, and Eastern Europe.

Procurement and use

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Smartphones have become an essential tool and accessory for their users. The devices are used for many different purposes, taking on the roles of other small electronic devices such as digital cameras.[7] Smartphone use is highly focussed in use of applications and the internet, offering its user different services from instant messaging and entertainment to navigation, online banking and health and fitness monitoring. Consumers, public procurers and buyers at smartphone retailers and network companies have a significant role to play in determining what kind of functionality is expected from smartphones and how they are designed and produced.

Concerns

Consumers increasingly say they expect their smartphones to be sustainably produced, easy to dismantle, repair and recycle.[18] However institutional buyers, public procurers and especially consumers lack awareness about reliable sustainability standards and what criteria can be used to inform sustainable purchasing decisions. Furthermore, the rise of online retail (Amazon, AliExpress, DX etc.) make it easier than ever to buy a cheap smartphone from abroad (e.g. from China). Such devices do not necessarily comply with the high environmental and social standards and regulations of the market where the phone is used.

Smartphones become more powerful over time. Consequently, the energy consumption of their components, such as chipsets and screens, increases. It has become common for applications installed on smartphones to track user location, contributing to higher battery drain as well as privacy concerns.

The voice and data networks which underpin the growing use of smartphones also have significant environmental impacts.[19] According to Ericsson, average monthly mobile data consumption per smartphone has grown between 2012 and 2017 from 450 MB to up to 3.9 GB or 6.9 GB in Western Europe and North America, respectively. It predicts that monthly mobile data traffic per active smartphone in North America will reach 26 GB in 2022.[20] These projections have made some Finnish network operators question the future of unlimited data subscriptions.[21]

Some studies estimate that if there is no significant improvement in the energy efficiency of communication technology[ix] the sector as a whole could contribute more than 20% of global greenhouse gas emissions by 2030.[22] While mobile networks are becoming more energy efficient, the rapid growth in data traffic may outweigh this causing their total energy consumption to rise. Furthermore, increased transmission

[ix] This includes personal computers, mobile phones, TVs and home entertainment systems, network infrastructure, data centre computation and storage; as well as the production of the listed categories.

speeds require continuous
updates of the physical infrastructure underpinning smartphones (2G>3G>4G>5G), consuming non-renewable natural resources in the process.

Additionally, data centres, where smartphone user data (e.g. photos, videos), or content provider data (e.g. music, maps, apps and their back-end data) is stored use ever more electricity.

Best practices

Policy

- Sustainable public procurement criteria extended to smartphones.
- Adopt circular economy and social sustainability principles in the sustainable public procurement criteria covering use as well as sourcing.

Industry

- Develop active networks which adjust electricity consumption based on the activity of users and build zero-emission radio access networks to increase energy-efficiency of telco networks.
- Software developers design applications that demand minimal data in order to function.

Consumers, institutional buyers, public purchasers

- Awareness about the sustainability impacts of smartphones and their use. Awareness about the environmental labels and sustainability standards available to guide purchasing decisions.
- Consumers are conscious about the use their phones and use them for sustainable purposes in their home and work lives; reducing energy use at home, car sharing or reducing waste.

Case studies

Sustainable public procurement:

In the US Federal government agencies and many state, provincial, and local governments have an option to buy electronics with better sustainability credentials (including mobile phones) from the EPEAT registry, where manufacturers state the environmental performance of their products. The Green Electronics Council then audits these claims on an ongoing basis.

The European Commission has developed comprehensive guidance for green public procurement (GPP) and it encourages Member States to develop National Action Plans for GPP. The guidance also covers mobile phones. Many Member States have gone beyond the EU guidance and have specific legislation and regulation in place to include environmental and social sustainability criteria. For example, Scottish Procurement established a new suite of frameworks for the supply of ICT client

devices in 2016, which included
mobile phones. In the Netherlands guidance on sustainable procurement is focussed in the knowledge and expertise network PIANOo, which provides guidance and criteria for sustainable procurement, including guidance on circular public procurement. There are several pilots currently running to test these guidelines in practice. The Finnish Government has adopted a resolution concerning the promotion of new and sustainable environmental and energy solutions in public procurement. The resolution requires government procurement units to take environmental and energy perspectives in all public procurement decisions.

In Japan the Law on Promoting Green Purchasing sets out criteria including provisions for material efficiency and it specifically covers mobile phones.

The Electronics Watch network of more than 200 public sector buyers in six European countries work together to ensure respect for labour rights and safety standards in their electronics supply chains. This allows more effective monitoring and addressing issues than any single public buyer could accomplish on its own.

Certification Schemes, standards and ecolabels

There are sustainability standards and product labels available that have been specifically developed to help customers purchase more sustainable smartphones. The scope of the criteria used and extent of verification varies among programs. Criteria may include energy use, sustainable material use, product life extension, hazardous materials, conflict minerals and social responsibility. However, adoption of these standards has been relatively low so far. There is a need for greater engagement and demand from purchasing organisations, consumers and policymakers. Purchaser requests are a primary driver of sustainability for the smartphone industry.

- TCO Certified is an independent sustainability certification for IT products, including smartphones, displays and computers. Criteria used for TCO Certified cover environmental and social responsibility from a life cycle perspective. Compliance with all criteria is independently verified. TCO Certified is a type 1 Ecolabel in accordance with ISO 14024. This means that criteria development is based on scientific principles and involves multiple stakeholders and experts in an open development process. Currently no mobile phone models carry this certification.
- ECOLOGO Certification (UL 110 standard); UL (Underwriter Laboratories) has produced a lifecycle based environmental sustainability standard for mobile phones. Several models of Samsung, Huawei, LG, HTC and others have achieved the standard. The US EPEAT registry uses this standard as part of its environmental criteria for mobile phones.
- The Blue Angel RAL-UZ 106 is an environmental label for mobile phones in Germany. So far, Fairphone 2 has received the Blue Angel certification based on criteria set in 2013. New criteria putting more emphasis on social sustainability were developed and published in 2017, however no mobile phone models have yet achieved the certification based on the new criteria.

Decarbonising telco networks

Some telco network operators have developed innovative solutions to improve energy efficiency in their networks. For example, Nokia's AirScale Base Stations have 60% lower energy consumption than its previous generation radio access solution.

Modernising a typical legacy base station site to Single radio access network (SRAN)[x] can achieve up to 70% energy saving.[23]

Huawei has also developed technologies to reduce the energy usage of base stations. These can lower the electricity consumption of remote radio units by more than 20% during non-peak hours.[24]

Decarbonising radio access networks (RAN) also requires greater use of renewable energy and innovative energy-efficiency solutions such as liquid cooling of base stations (BTS) connected to local or district heating.[23]

Sustainable smartphone use

Smartphones have great potential for driving sustainable development by enabling the widespread adoption of sustainable applications and other mobile enabled technologies, such as data monitoring systems, Internet of Things (IoT) and Machine-to-Machine (M2M) applications.

Examples of the areas of application include:

- Transport: car and ride-sharing, ride-hailing, demand-responsive public transport;
- Food waste reduction;
- Building energy monitoring and energy efficiency;
- Smart agriculture;
- Water quality monitoring;
- Management of buildings;
- Smart collection systems for recycling and reuse;
- Health and fitness monitoring.

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[x] Single radio access network can support multiple mobile phone standards (GSM, UMTS, LTE) at the same time; in the traditional base station system only one standard can be supported.

Product life extension

It is ever more important to find ways to reuse existing phones and their functioning parts given their high replacement rate and the fact that more and more people are using them. Their lifespan can be extended through design, creating a network of repair points, legislation on repair and lower taxes on repair and software upgrades.

Consumers increasingly view the concept of refurbished smartphones in a positive light. The perceived environmental benefits and awareness of refurbishing have a positive impact on the consumers' purchase intention for refurbished smartphones.[25]

Business models focussing on leasing of smartphones can contribute to an effectively longer lifetime of higher-end smartphones bought by early adopters. Through leasing, these consumers get access to the latest device which after a certain period (6 months, one year, or two years) is resold to a second user. There are also models which go beyond traditional leasing. An example is Fairphone's Phone-as-a-service model where ownership of the product is retained by the smartphone company and the device or its modules can be leased to multiple subsequent customers. This type of model can thus facilitate take-back and the reuse or recycling of materials and components, leading to improved resource efficiency.[26]

Concerns

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Smartphones are not known for their durability. The most common causes of failure – dropping on a hard surface and immersion in water – are normally considered as misuse and not covered by legal guarantees although phones can be designed to withstand such handling. When a smartphone fails, it is often difficult to claim the warranty, especially later than six months after purchase when the onus of proving the device is at fault shifts from the producer to the consumer.[7]

Whilst the lifespan of mobile phones was reported to decrease from 4.8 to 4.6 years (-3%) between 2000 and 2005,[27] modern smartphones hardly ever last or are used that long. It is estimated that currently the average replacement rate of smartphones globally is around 21 months.[28]

Another issue is low consumer awareness of minimum guarantee periods which can be an obstacle to longer product lifetimes.[7] The EU Consumer Sales Directive defines a two-year legal warranty on products sold within the EU.[29] However, consumers do not often know their rights and in some cases are misled by retailers about the warranty length.

Furthermore, smartphones are often not designed to be easily repairable[30] at least not by non-authorised repairers or by consumers themselves. Lack of availability of original replacement components to non-authorised repairers hinders many smartphones getting a second life. Furthermore, labour is expensive in many developed countries. That makes it less affordable, or even sometimes prohibitively expensive, to repair a broken smartphone in the country of use. [7]

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Smartphones can be designed, intentionally or unintentionally, to be obsolete in a few years. For example, software upgrades could play a significant role in extending the useful lifetime of a smartphone, but that depends on its hardware being designed in such a way as to facilitate such upgrades. Moreover, lack of software support during the lifetime of a smartphone might result in it becoming obsolete while its components are still fully functioning.[7]

Best practices

Policy

- Introduce minimum standards for durability into Ecodesign policies.
- Make declaration of product lifetime compulsory and link legal warranty to the expected lifetime.
- Ensure an open regulatory environment for repair, securing consumers' rights to buy spare parts, use diagnostic tools and access repair manuals.
- Public procurement; include reparability, preference for refurbished phones and service/leasing contracts as key criteria for contracts.
- Adjust implementation of the EU Consumer Sales Directive or similar regulations at the national level to include a requirement of software support for the full legal guarantee period.
- Extend the onus of proof on seller in case of a fault within the declared life expectancies or from 6 months to the full minimum guarantee period.
- Lower taxation, such as lower VAT on repairs and spare parts.

Industry

- Design for easy reparability, remanufacturing, upgradeability and recyclability. Spare parts available even after the device has been discontinued from production.

- Establish repair-friendly industry mechanisms to remove industry barriers to smartphone repair and to promote the quality of repair and the re-usability of smartphones.

- Phone companies offering leasing or Product-as-a-Service models that ensure product life extension with a legitimate second hand market and a plan for end-of-life for used smartphones.

Consumers

- Consumers are aware of the minimum guarantee period via labelling on the phone or other means.

- Users keep and value their smartphones for a long time. Taking a defective phone to be repaired becomes the norm.

- Consumers consider alternatives to buying and owning a new phone; e.g. buying a second hand phone or leasing.

Case studies

Product life extension through policy measures

Planned obsolescence

In France the decree 2014-1482 obliges French producers to inform sellers about the durability of their products and the availability of the spare parts; retailers have to convey this information to consumers with fines for non-compliance. Planned obsolescence, defined as 'all techniques by which a producer seeks to deliberately limit product life in order to increase the replacement rate', becomes a legal offence punishable by large fines.

Lowering the VAT on repairs

In Sweden, lower VAT on repairs of certain products has been already introduced. To further stimulate repairs, repair costs are now also 100% tax deductible. In Belgium, VAT on repair for bicycles, shoes and leather goods, clothing and household linen is set at a low rate of 6%. However, in both countries these tax breaks do not yet cover repairs to ICT –products.

Product life extension as key criteria in public procurement

In Scottish public procurement, the framework contract for Information and Communications Technology (ICT) Client Devices aims to extend products' useful lives while ensuring compliance with the EU's Waste Electrical and Electronic Equipment (WEEE) Directive and data security requirements. Emphasis is placed on repair, refurbishment and re-use of devices and the framework seeks to embed this as a key requirement and encourage producers to go further.

Extending the legal warranty period

The minimum legal guarantee set by the Consumer Sales Directive in the EU is two years with allowance for Member States to increase this. In Sweden the minimum guarantee for mobile phones is set at three years, in Norway, five years and in Finland it is linked to the expected lifetime. Extending minimum legal guarantees can theoretically support green business models by extending the period over which sellers support repair services financially.[7]

Prompting repairs

IFixit is a global community platform which teaches people how to fix everyday products. On the site anyone can create a repair manual for a device and anyone can edit the existing set of manuals to improve them. Members can also buy repair kits and tools via the platform. The site has repair manuals for most smartphone brands and models. It also publishes a repairability scoretable for smartphones.

Ifixit also campaigns for 'Right to repair' legislation that has been passed in eight US States[31], requiring manufacturers to sell repair parts to customers and independent repair shops. So far Apple has opposed this legislation together with other large manufacturers on the basis of customer safety, security and intellectual property risks.

The Repair Roundtable in Germany encourages repair as a social good. It brings together representatives of industrial manufacturers, the repair industry, non-governmental environmental and consumer protection organisations, scientists, and community repair initiatives.

Leasing

Business models based on leading can contribute to the extension of smartphones' life cycle, at least in theory. The leasing company retains ownership of the phone and has an interest in keeping its value high, by repairing or upgrading it, in order to eventually sell it on. However, from the consumer perspective many of the leasing deals currently available seem to be financially most beneficial to those consumers who are seeking to upgrade their phones early on.[32] The examples below represent some of the leasing models currently available in the market. Whether these contribute to greater sustainability depends on what actually happens to the leased phones after they are returned to the service provider; this is not always clear from the description of the service.

- Various US mobile carriers (e.g. AT&T, Sprint) lease smartphones for a year and after that resell them for approximately 2/3 of the original price.
- Telenor Bulgaria's 'Smartphone for All' programme. Telenor Bulgaria leases their own branded phones and also provides a service to prolong their life.
- Apple's iPhone upgrade program allows the customer to upgrade to a new phone every year.

Phone-as-a-service model

Leasing a smartphone for a limited time (e.g. one year) after which it is sold on the second-hand market is one example of extending the product lifespan. Fairphone has developed Phone-as-a-service, a model that goes beyond the traditional leasing model. The focus of the value proposition here is not the ownership of the product itself, but on the performance of the product (the service). The service provider retains ownership of and responsibility for the product, which incentivises the design

of high quality, low maintenance and durable products. A key difference between traditional leasing and Phone-as-a-service, from the environmental point of view, is that in the leasing business model there is no incentive for extending the lifespan of the device once is has been sold to the second user. In Phone-as-a-service the device, or its modules, can be leased to multiple subsequent customers. The only limitation is the lifetime of the modules which in part can be influenced by its design. The more modular a phone is, the more suitable it may be to further optimise the value creation based on the economic life of individual modules rather than of entire devices. Here the state-of-the-art hardware management is critical to optimise the use of individual modules. Fairphone is launching a pilot in 2018 offering 'Fairphone-as-a-service' to businesses.[26]

End-of-life

The collection rates for recycling, refurbishing and/or remanufacturing smartphones in Europe are around 15%, and the secondary (e.g. refurbished) smartphone market is only a small fraction (6%) of the primary market.[33] Shorter lifecycles of smartphones and the limited end-of-life scenarios lead to electronic waste and the loss of scarce materials.[34]

Concerns

Extended producer responsibility (EPR) is mandatory for electronic equipment producers in many jurisdictions, such as in the EU, Canada and many the U.S. states. The producers are obliged to pay in to the recycling schemes for WEEE to ensure the waste is recycled appropriately and does not end up in landfills. However, the collection rates for WEEE still remain low.[35] Some of the waste ends up in countries without appropriate recycling facilities as a result of second hand phones being sold overseas through informal routes, leading to environmental pollution and health risks in these countries.[36] This adds to the environmental damage caused by e-waste generation from internal consumption in rapidly growing economies where consumption of electronic goods grows faster than recycling infrastructure develops. There are also serious concerns over the working and living conditions of people working in the informal WEEE management sector in these countries.[6]

Waste regulations concerning ownership and treatment of WEEE restrict refurbishers that prepare discarded phones for reuse from participating in the second hand market.[7] Additionally, when the consumers replace their old smartphone, they often fail to dispose of them by selling them, giving them away for reuse or recycling them. Instead they keep them unused stored at home, which means that the valuable raw materials within them cannot be used to make new products and virgin raw materials have to be extracted instead.[37]

Anti-theft and security software installed on smartphones can also be problematic as they can only be removed by the original owner. Retrieving working phones from waste streams is made impossible in cases where such software is installed.[7]

Best practices

<u>Policy</u>

- Incentivise technology transfer to facilitate the development of appropriate WEEE recycling infrastructure in developing countries, to prevent e-waste accumulating in landfills from second hand smartphones.
- Adopting refurbishment certification standards to allow responsible refurbishers outside of the WEEE schemes to participate in the second hand market.
- Investigate the possibility of setting up an authority that could potentially disable anti-theft and security software installed on smartphones, software that otherwise can only be removed by the original owner.

Industry

- Establish producer-specific or collaborative industry take-back schemes that allow the recovery of valuable materials to be reused in new products.
- Full transparency about the secondary materials recovered and used in new products.
- Ensure transparency about the final destinations of WEEE.
- Work with partners in second hand markets in developing countries to ensure appropriate recycling facilities for end-of-life phones are in place.
- Participate in the global e-waste clean-up by material offsetting; signing up to material offsetting programmes (where old discarded phones are collected from countries without appropriate e-waste recycling infrastructure to be appropriately recycled in countries with good recycling infrastructure) when putting new devices in the market.
- Incentivise consumers to return their old devices at the time of purchasing a new one, to avoid unused phones ending up stored at home.

Consumers

- Give or sell old devices to family and friends to use, allowing for so-called use cascading, or sell unwanted devices through second hand platforms.
- Recycle any device as soon as it becomes unrepairable (minimise the time a discarded phone is stored at home).
- Institutional buyers and public procurers: Participate in the global e-waste clean-up by material offsetting; sign up to material offsetting programmes when purchasing new devices.

Case studies

Global take-back schemes:

Most of the big manufacturers have extensive global take-back programmes in place. However, apart from Fairphone, the companies lack transparency when it comes to providing information about the destination of the recycled devices and the amount of secondary materials sourced through take-back schemes. Apple has developed the innovative LIAM-robot, designed to disassemble 1.2 million iPhone units per year. If significantly scaled up, this would take Apple nearer to closed-loop production.

E-waste recycling in India

Karo Sambhav is an e-waste Producer Responsibility Organisation (PRO) based in India which aims to develop a sustainable e-waste management system across the country. Karo Sambhav sets up comprehensive EPR programmes, take-back schemes and engagement programmes and partners with industry associations, pollution control boards, state IT departments, municipal corporations, NGOs, informal sector waste pickers, collectors and aggregators, and responsible recyclers across India.

Establishing a Material-Cycle Society in Japan

In Japan recycling rates for certain materials are exceptionally high, for example as high as 98% for metals. This is mainly due to a very comprehensive framework of legislation and regulations which encourage material circulation. Both the producer of products and the consumer pay towards appropriate recycling of products at the end of their lives.

Material offsetting - Closing the Loop One-for-One programme

Closing the loop, based in the Netherlands, collects the client's redundant phones and reuses or recycles them. For each redundant phone a waste phone is collected from developing countries with no recycling infrastructure and brought back to developed countries to be appropriately recycled. The programme can also work in reverse – for each new phone sold the phone producer buys an old phone from a developing country to be transported for recycling in countries with appropriate infrastructure.

Key recommendations

This section outlines key recommendations from the Sustainable Smartphones Working Group for governments, industry and consumers to accelerate the shift towards sustainable consumption and production of smartphones. These recommendations are derived from the analysis presented in pages 5-29 of the report.

FOR GOVERNMENTS

- DESIGN: Extend the EU Ecodesign Directive product criteria or similar regulations in other jurisdictions to cover smartphones. Extend the criteria to cover resource efficiency in addition to energy efficiency.
- RAW MATERIALS: Ensure comprehensive regulation on critical raw materials (CRM), conflict minerals (3TG) and high-risk minerals beyond 3GT such as copper, cobalt and lithium as well as a compliance monitoring system in place. Incentives for industry to go beyond compliance.
- PROCUREMENT AND USE: Introduce sustainable public procurement principles and criteria covering smartphones that include environmental as well as social sustainability criteria.
- PRODUCT LIFE EXTENSION: Ensure an open regulatory environment for repair, securing consumers' rights to buy spare parts, use diagnostic tools, and access repair manuals.
- PRODUCT LIFE EXTENSION: Introduce tax breaks and lower VAT for repairs and spare parts for all product categories including smartphones.
- PRODUCT LIFE EXTENSION: Make declaration of product lifetime compulsory and link the legal guarantee period to the expected lifetime. Extend the burden of proof on the seller from six months to the length of the minimum guarantee.
- END OF LIFE: Incentivise technology transfer to facilitate the development of appropriate WEEE recycling infrastructure in developing countries to prevent accumulation of WEEE in landfills from second hand smartphones.

FOR INDUSTRY

- DESIGN: Commitment to Ecodesign or Design for the Environment principles covering designing for reuse, easy reparability, remanufacturing, upgradeability, take-back, recyclability, non-dependency of harmful substances and critical virgin raw materials.
- RAW MATERIALS: Full disclosure of the details of the materials used in smartphones including secondary materials, closed-loop materials, critical raw

materials (CRM), conflict
minerals and high-risk minerals. Integrating responsible sources into supply chains that go beyond risk management and support social and environmental development for the miners of raw materials and surrounding communities.

- PRODUCTION: Comprehensive and transparent supplier engagement programmes in place that go beyond standard supplier audit schemes and are dedicated to improving working conditions and environmental sustainability in the supply chain.

- PRODUCTION: Involvement in and development of industry-wide multi-stakeholder programmes that are dedicated to improving working conditions and environmental sustainability in the supply chain.

- PROCUREMENT AND USE: Introduction of greater share of renewables, energy-efficiency and resource efficiency measures in the infrastructure enabling smartphone data use and networks.

- PRODUCT LIFE EXTENSION: Establish repair-friendly industry mechanisms to remove industry barriers to smartphone repair and to promote the quality of repair and the re-usability of smartphones.

- END OF LIFE: Establish producer-specific or collaborative industry take-back schemes that allow the recovery of valuable materials to be reused in new products.

- END OF LIFE: The sellers of second-hand smartphones ensure there is a viable end-of-life solution for them, to prevent accumulation of e-waste in countries lacking recycling infrastructure.

FOR CONSUMERS

- PROCUREMENT AND USE: Consumers and institutional purchasers are aware of the environmental and social sustainability impacts of smartphone production and consumption as well as environmental labels and sustainability standards available informing the purchase decision.

- PROCUREMENT AND USE: Consumers and institutional purchasers consider other alternatives to buying and owning a new phone; buying a second-hand phone or leasing.

- PROCUREMENT AND USE: Consumers use smartphones and apps to help them move towards sustainability, both in their homes and working lives; for example reducing energy use at home, car sharing or reducing waste.

- PRODUCT LIFE EXTENSION: Consumers are aware of their legal rights as a consumer regarding legal product guarantees.

- PRODUCT LIFE EXTENSION: Consumers keep and treasure their smartphones for a long time. Getting a defective phone repaired becomes a norm. Consumers sell their functioning phones to new users or to refurbishers/second-hand platforms when they no longer have a use for them.

- END OF LIFE: Consumers deliver used and no longer functioning phones to take-back initiatives when they are no longer reparable. Consumers are aware of the opportunities to recycle their phones responsibly.

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