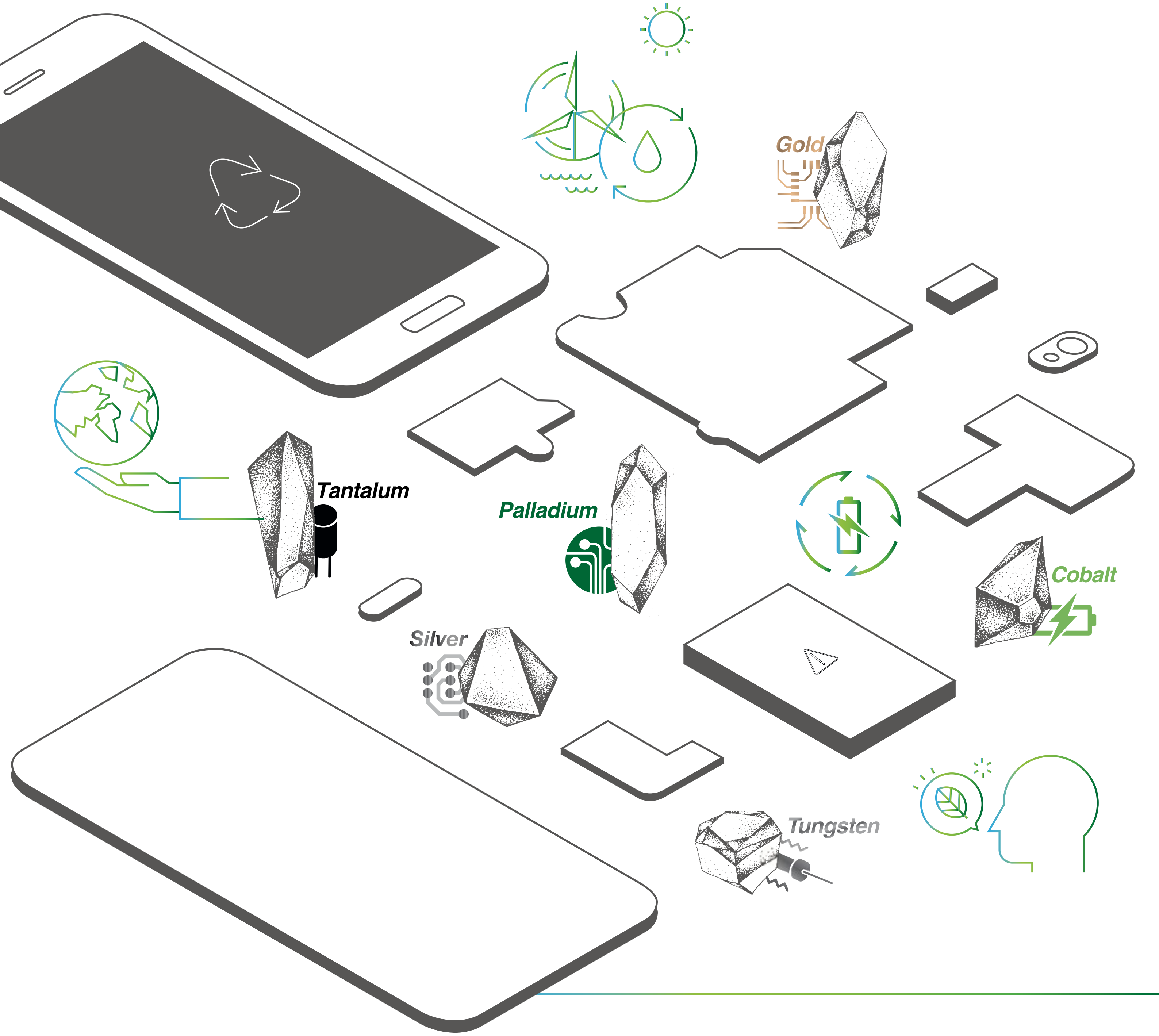
Resource Efficiency in the ICT Sector

Executive Summary



GREENPEACE

Resource Efficiency in the ICT Sector
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Background and introduction

Mobile electronic devices such as smartphones and tablet PCs have become an integral part of our daily lives and are used for virtually all aspects of modern communication and information sharing. While consumers and societies embrace the advantages of these modern information and communication technologies, NGO reports and other surveys reveal devastating environmental and social practices in the mining, manufacturing and disposal of mobile electronic devices. This includes UN-reports of warlords financing their existence with mining and trading of "high-tech minerals"; reports from devastating practices in cobalt-, tin-, gold-, palladium- and rare earth-mining; substandard working conditions in manufacturing and assembly and irregular recycling and disposal in third-world countries. In addition to these reports, it is well known that some production processes, such as the microchip manufacture, consume huge amounts of energy, water and chemicals. Moreover, electronic devices also contain substances which have adverse impacts on human and environmental health if not properly managed at the end of the product lifetime.

Against this background, Greenpeace asked Oeko-Institut to give an overview of all the resource relevant steps of smartphones and tablets. Thus, the study's aim is to present a comprehensive analysis of the resource related issues of smartphones and tablets, with relevance for the environmental and human rights. In addition, the study aims to present existing approaches for mitigating the negative impacts identified. These approaches are described in the context of the ongoing scientific and policy debate and are meant to support further discussion and processes to find solutions.

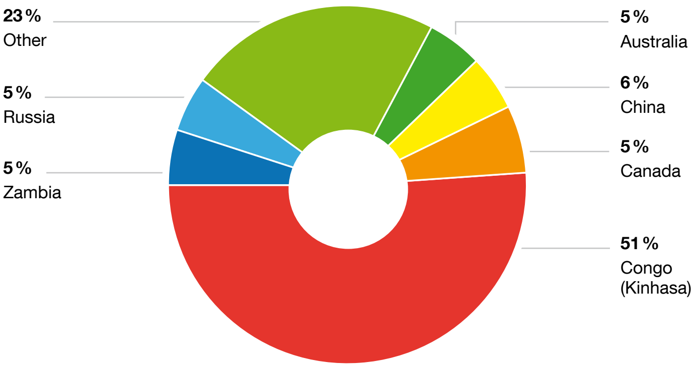
While indirect impacts such as the energy and resource requirements of network infrastructure and data centres are not part of this study,all resource relevant processes within the life-cycle of smartphones and tablets are considered. This means that this study solely addresses issues influencing resource consumption. Other environmental issues such as the use and emissions of hazardous substances (like brominated flame retardants or PVC) within the product life-cycle and the social conditions during mining, manufacturing, use and disposal are not addressed in detail in this study. Starting with an analysis of the global market situation, this study includes the extraction of raw materials, the manufacturing of components and devices and their relation to the total life-cycle impacts, an analysis of product life-expectancy and the debate on obsolescence and the status and challenges of recycling. In addition, this study entails an assessment of the legislative framework – in particular within the European context – and voluntary improvement initiatives.

In compiling this study, Oeko-Institut holds manifold experiences in related fields such as mining and mineral processing, hazardous substances, life-cycle assessment, eco-labelling and recycling.

Summary & recommendations

Smartphones and tablets are truly globalised products: with total annual sales numbers in excess of one billion devices, they are used in all parts of the world and by a broad range of income groups. The raw materials production and manufacturing also follow a global pattern: the cobalt for the batteries and the tantalum for capacitors are sourced from the DR Congo, among other places.

Country shares of primary cobalt production in 2014



Source: U.S. Geological Survey (2015b)

The palladium for electronic components mainly comes from the Russian city of Norilsk and from South Africa; and the silver needed for soldering alloys comes from mines on all continents. The manufacturing of technologically demanding components such as processors, memory-chips and LCD-panels is dominated by industries in Korea, Taiwan, China and Japan. Less demanding parts such as capacitors and inductors are also manufactured in Thailand and Malaysia. The assembly of devices is done in countries like Brazil, China, India and Korea. This global travel often continues after the first use of smartphones and tablets: as demand for affordable IT-devices is high in many developing countries, these devices are often shipped to such regions to start a second product life or to be used as a source of spare parts.

Within these globalised patterns, smartphones and tablets are interlinked with a variety of sustainability issues, which can be summarised briefly as follows:

- The extraction of raw materials is often associated with human rights risks. The most prominent example is the extraction of raw materials in the eastern parts of the DR Congo where various armed groups use the local artisanal mining for tin, tantalum, tungsten and gold to finance their operations. In addition, other raw material supply chains of the EEE industry are also prone to human rights violations. This includes the sourcing of cobalt from south-eastern parts of the DR Congo and the violent labour disputes in South African platinum and palladium mines. Although mining and processing of ores are not always the dominant factors in these social hot spots, consumers and producers should be aware that the supply-chains of smartphones and tablets can be interlinked with these situations.

- Mining and processing of ores in many regions of the world are a major source of pollution and environmental degradation. Due to the large volumes of smartphones and tablets that are sold, this sector is a major consumer of materials such as cobalt, palladium, tantalum, silver, gold, indium and magnesium. Mining and processing of these materials and other minerals can lead to massive local pollution severely affecting human and environmental health.

- The production of smartphones and tablets is highly energy-intensive – particularly the production of display modules, printed circuit boards and integrated circuits. It is estimated that the life-cycle based greenhouse gas emissions of one smartphone account for 16 to 110 kg CO_2e[1], while the range for tablets is between 120 and 240 kg CO_2e, based on a number of studies. These broad ranges, however, are not necessarily the result of "better" or "worse" models, but are due to methodological differences between the LCA studies (e. g. the selection of certain datasets and databases and other methodological considerations for carrying out the LCA). For both product types, manufacturing is the major life-cycle step in terms of energy input and greenhouse gas emissions; other life-cycle steps such as transport, product-use and end-of-life management are comparatively less relevant.

- It becomes obvious that a major opportunity to reduce the total environmental and social impacts caused during raw materials extraction and manufacturing of smartphones and tablets is to use the devices as long as possible. Nevertheless, it is observed that smartphones and tablets are often used for no longer than 3 years. In many cases, the reason for early replacement of smartphones and tablets is not attributed to a defect. A large number of these products are replaced even though they are still functional (psychological obsolescence). The influence of short innovation cycles, as well as advertising and the tariff models of service providers seem to play a decisive role in this regard.

- End-of-life management of smartphones and tablets is still far from perfect. Although mandatory legislative instruments such as the RoHS Directives in the EU, China, Korea and California widely ban the use of relevant hazardous substances in EEE, imperfect collection and processing causes significant losses of raw materials globally. In addition, recycling practices in many developing countries and emerging economies lead to significant pollution, e. g. from crude recycling practices such as the open burning of cables to recover copper. These problems are also aggravated by exports of used and end-of-life devices from industrialised to developing countries such as Ghana.

On the level of individual devices, many of the indicated impacts are quite moderate if compared to other aspects of our daily consumption: while the average annual life-cycle based impact of a smartphone leads to about 37 kg CO_2e emissions and that of a

1 Equivalent carbon dioxide (CO_2e) is a measure for describing how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide (CO_2) as the reference.

tablet to around 80 kg CO_2e [2] (note however that this does not include network usage as well as data centre services, for example for online storage or video streaming!), the average annual life-cycle based greenhouse gas emissions of a washing machine or a TV are associated with around 150 kg and 307 kg CO_2e respectively. In addition, in terms of total material consumption, it should be considered that devices such as TVs and cars obviously consume more non-renewable resources than smartphones and tablets.

Nevertheless, these comparisons should not be taken as an excuse to continue with business as usual and to declare the problems outlined in this report as irrelevant. In sum, impacts are significant because of the large size of the global smartphone and tablet market. Various voluntary and mandatory approaches such as on-the-ground projects to improve conditions in artisanal mining, the restrictions of hazardous substances (RoHS), regulations on sound-end-of-life management and efficiency gains through improved manufacturing technologies have already led to significant improvements in the last decade. Consumers, industry and policy-makers are called on to continue on this path and strive for more sustainable life-cycles of electronic gadgets.

From the current perspective, the most relevant potential measures to further improve the overall impacts of smartphones and tablets are:

Increasing efforts in the field of sustainable mining

The electronics industry should mainly focus its effort on the supply-chains of those materials where electronic devices have a pronounced share of total world consumption (e.g. cobalt, silver and others). Generally, these efforts should go beyond de-facto boycotts to avoid unsustainable production and extend into industry partnerships to increase the share of sustainably mined raw materials globally.

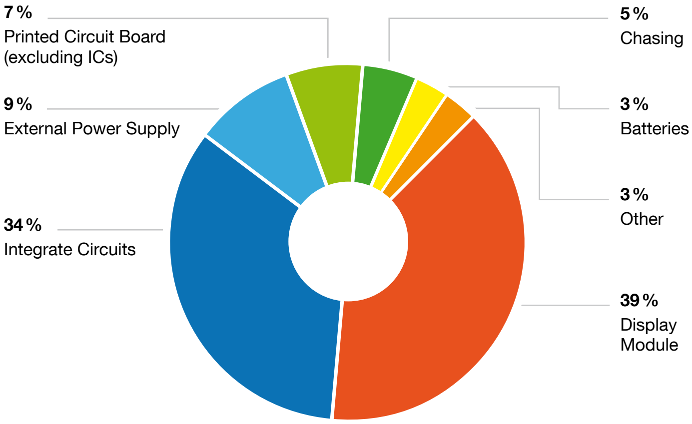
Conducting human rights due diligence

The mining and processing of ores, but also the labour intensive assembly stages are known to be associated with various human rights risks such as conflict financing and violations of ILO core conventions. Producers should continue to address these problems, in particular through implementing comprehensive human rights due diligence policies and measures. This fits into the framework of the UN Guiding Principles on Business and Human Rights, which explicitly call on businesses to protect and respect human rights, and to remedy human rights violations within their business sphere.

Continuous improvement to reduce energy-input and chemical use in manufacturing

A handful of components, such as memory (RAM), printed circuit boards and displays cause almost 80 % of the total greenhouse gas emissions of manufacturing. While the supply chain of smartphones and tablets is very complex, concentrating on improving the environmental performance of the suppliers of above mentioned components seems to be an appropriate approach. Designing energy efficient clean room technologies, using compressed air efficiently, implementing energy efficient soldering as well as cooling technologies, minimising PFC-emissions and substituting and optimizing the use of VOC-based solvents are a few innovative approaches which can be enforced in the supply chain base. The key would be to install monitoring systems with suppliers to closely monitor savings on energy consumption and greenhouse gas emissions.

Share of components in the greenhouse gas emissions (kg CO_2e) of the production of a tablet



Source: U.S. Geological Survey (2015b)

Conducting and publishing robust and transparent LCAs

The robustness and value of publicly communicated LCA results depends on the use of a standard LCA methodology and making underlying assumptions, decisions and data use transparent. These aspects are crucial indicators for the quality of any LCA project. Thus, it is recommended that companies conduct LCA according to the full requirements of ISO 14044 including requirements for conducting critical reviews, taking into account additionally agreed sector specific rules, and providing as much transparency as possible for interpretation of results. The European Commission initiative, which builds on ISO 14040 and 14044 and aims to define all decision points to maximise comparability and robustness of results, is noteworthy. The initiative and legislative process is not yet completed but could potentially provide a stimulus to more widespread availability of high quality LCA data. In the meantime, companies are advised to conduct LCAs for major products that contribute substantially to their overall sales volume as well as at major product development phases, such as during design of a new product or to support decisions related to material and supplier selection.

Further reducing the types and amounts of hazardous substances

Although various legislative efforts worldwide have led to a significant reduction of hazardous substances in electronic devices, devices like smartphones and tablets are still not free from such chemicals. Thus, additional efforts are needed that go beyond the current legislative requirements. Amongst others, this could include the global application of the chemicals assessment applied under REACH and a support of initiatives such as the Zero Discharge of Hazardous Chemicals by electronics manufacturers.

2 Annual life-cycle based greenhouse gas emissions are calculated with following assumptions: (1) Life-time – smartphones 3 years, tablet-PC 3 years, television 6 years and washing machine 10 years; (2) Total life-cycle based greenhouse gas emissions: Smartphones 110 kg CO_2e, tablet-PC 240 kg CO_2e, television 1839 kg CO_2e and washing machine 1503 kg CO_2e.

Last but not least, efforts to phase out hazardous chemicals in EEE should be continued beyond the existing RoHS-frameworks.

Promoting longer product use by changing product design and business models:

Extension of product life-time is a decisive strategy to improve resource efficiency and the associated environmental and social impacts of manufacturing in the ICT sector. One of the main leverage points to increase the time products are used are the business models offered by the service providers. Rather than sending brand new models of smartphones when contracts are extended or renewed every 12 or 24 months, a more sustainable approach would be to set incentives to continue using the existing models. Simultaneously, service providers and manufacturers could complement the replacement of older models by implementing take-back mechanisms, guaranteeing safe data wiping and data transfer onto the new model and refurbishment, upgrade and resale for further use. From the perspective of product design, it is important that at least those components that are critical for limiting the usage time of smartphones and tablets are replaceable and upgradeable. These components are batteries, display, memory and storage. On the other hand, it is important that increased modularity of smartphones and tablets does not result in the opposite effect and lead to higher failure susceptibility. Thus, it is important that modular products – as well as other devices – undergo comprehensive durability tests, also under extreme use conditions, to ensure lower failure rates.

Further opportunities for design changes are standardised charging interfaces. Standardised chargers are not only convenient for consumers, but can also help to reduce the production volumes of new chargers, which are generally delivered with every new smartphone / tablet purchased. Although the standards and technologies for such design changes already exist, they have not yet been implemented on a broad scale.

Product design facilitating sound recycling

This is particularly relevant for the batteries containing cobalt, which have to be separated from devices for sound recycling. Rechargeable batteries in smartphones and tablets are one of the most important applications of cobalt, which is at least partly mined under quite dubious conditions in the DR Congo. As most recycling processes depend on quick and efficient processes, ideal design should facilitate battery removal without the use of tools and within a few seconds of manual labour input. Generally, it should be ensured that such design changes do not negatively affect product durability.

Facilitating re-use and recycling by improving collection systems for end-of-life devices

This means in particular that small electronic devices such as smartphones and tablets are collected separately from other waste and e-waste types such as household equipment. Collection needs to be organised in a way that provides sound and convenient disposal options for consumers. In addition, collected devices need to be stored and transported in a way that minimises damage to the equipment to facilitate possibilities for the re-use of devices. Finally, the separate collection of smartphones / tablets promotes possibilities for improved dismantling, e. g. removal of batteries.

Improving the overall recycling of smartphones and tablets

The recycling process for smartphones and tablets can be improved in many regions of the world. While in many industrialised countries improved dismantling can contribute to improved material recovery, most developing countries and emerging economies still lack capacity for environmentally sound recycling. While there needs to be a concerted global effort to address this situation, at the same time illegal waste shipments have to be reduced as far as possible. To strengthen recycling systems in developing countries and emerging economies, strategies should not be limited to the transfer of recycling technology, but should promote financing mechanisms that allow sound recyclers to be economically competitive against recycling industries that externalise costs onto society.