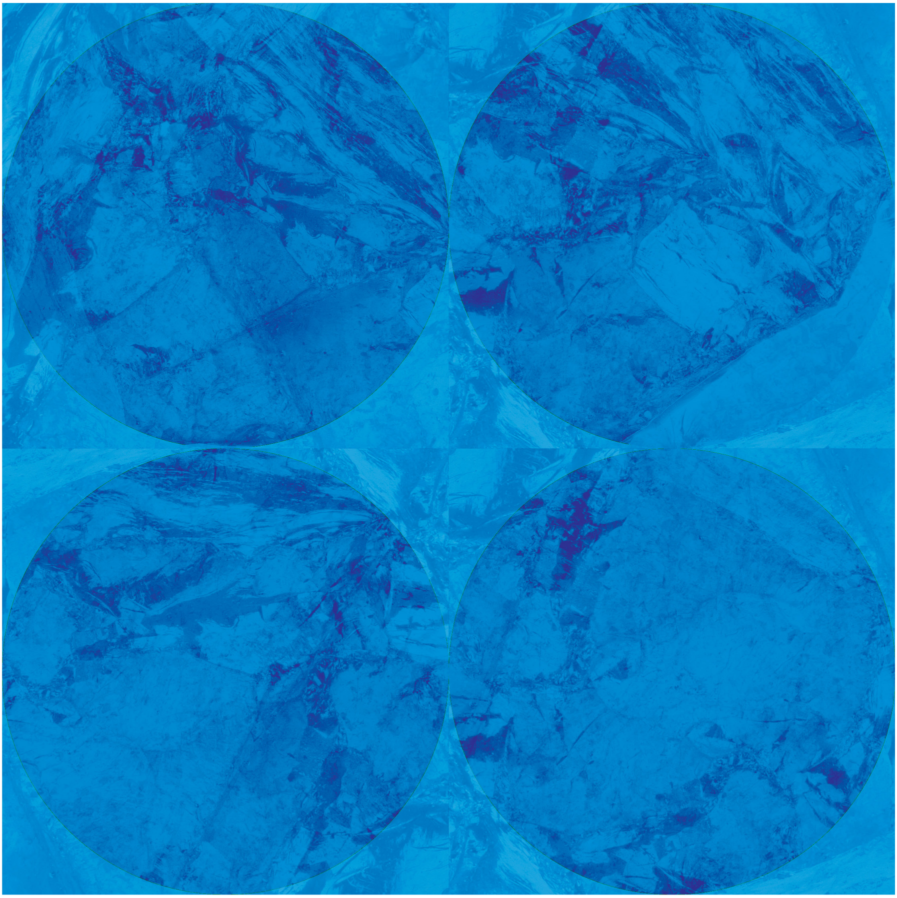
Guide to the Scoping Study



FAIRPHONE

THE DRAGONFLY INITIATIVE

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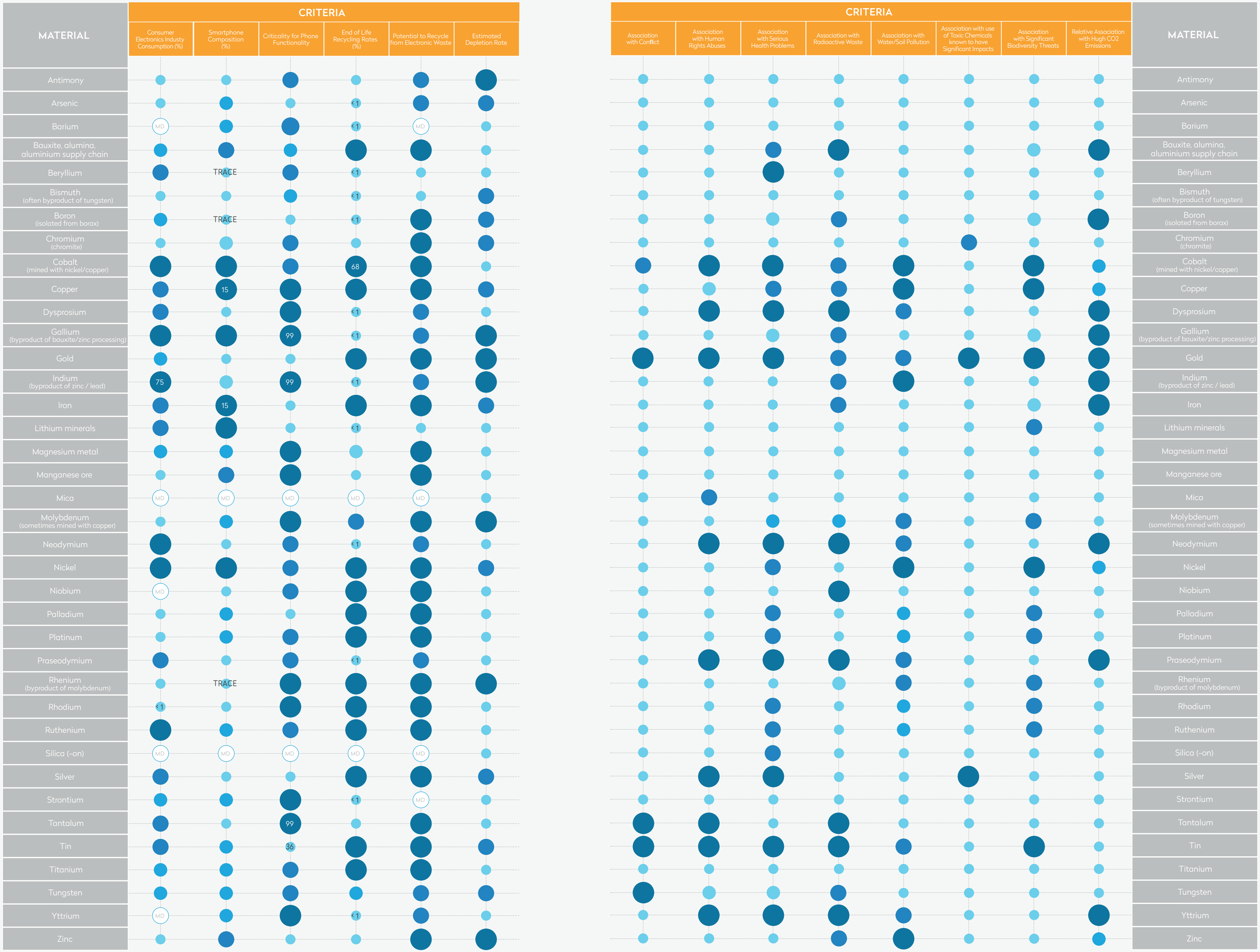
Why should you care about the materials in your phone?

To understand the issues surrounding the smartphone supply chain, we collaborated with The Dragonfly Initiative to examine 38 of the different materials used in mobile phones. The chart below shows how each material supply chain scores on certain material, social and enviromental aspects. We're using this information to prioritise which supply chains to engage with first, and determine where our involvement can deliver the greatest impact.



Key

- Low
- Moderate
- High
- Very High
- Missing Data

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Guide to the material scoping study

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Updated on 31 January 2017

The guide to Fairphone's material scoping study explains the criteria and indicators we used for our research. It is our first step in collecting this type of information and is far from complete. However, by sharing this document with the industry and others, we believe it can be a starting point for better understanding the issues related to materials sourcing and working together to improve these supply chains. We invite others to build upon our initial work and provide feedback so that we can update the document with additional, relevant information when it becomes available.

The rationale for this study was to focus on the different metals in our smartphones. We did include some non-metals like silicon or compounds such as mica minerals. Silicon is included because of its high relevance to smartphones and mica group minerals are included because of recent attention they generated due to issues associated with their extraction. By the same token we will consider adding other elements and/or materials in the future, such as graphite.

Note:
This study uses "materials" throughout as a general term, recognizing that the listed materials are not all metals or periodic elements.

Consumer electronics industry consumption

% consumed by consumer electronics industry
Low: 0 ≤ 5
Moderate: 5 < % ≤ 10
High: 10 < % ≤ 30
Very high: >30

This criterion measures the proportion of the total global consumption of a specific material that can be attributed to the electronics industry – specifically consumer electronics where data is available. This criterion helps Fairphone understand the potential influence and responsibility of the electronics industry to take action in a supply chain. Where the electronics industry is a major consumer of a material, there is potential to collaborate with brands and business partners to collectively influence the supply chain to make improvements, where improvements are needed. Where the electronics industry is only a minor consumer, other industries could be better positioned to address the issues in this particular material supply chain.

Sources:
USGS Mineral Yearbooks & Fact Sheets; mineral trade associations e.g. International Aluminium Institute, International Platinum Group Metals Association, International Copper Association.

Smartphone composition

% content of average smartphone
Low: 0 ≤ 0.5
Moderate: 0.5 < % ≤ 1.5
High: 1.5 < % ≤ 2.5
Very high: > 2.5

This criterion measures the estimated proportion of the total weight of an average smartphone that can be attributed to a specific material. This criterion helps Fairphone understand the potential influence and responsibility of the smartphone industry, and more specifically Fairphone itself, to take action in a supply chain. Materials that represent a significant part of the smartphone's composition could also represent opportunities to collaborate with other consumer electronics manufacturers to bring about positive change.

Sources:
Christian, B., Romanova, I., and L. Turbini (2012) "Elemental Composition of Over Two Dozen Cell Phones," Research in Motion; Mobile phone working group (2012) Basel convention, mobile phone partnership initiative, "Guidance document on the environmentally sound management of used and end-of life mobile phones".

Note:
Some estimates, such as the cobalt content, have been adjusted according to Fairphone's estimation. Estimates will be adjusted once more information becomes available.

Criticality for phone functionality

Substitutability Score - a score of 1-100 where 1 = substitutable and 100 = not substitutable because of unacceptable compromise to performance quality

Low: 0 ≤ 41
Moderate: 41 < % ≤ 54
High: 54 < % ≤ 68
Very high: > 68

This criterion describes the likelihood that a substitute can be found for a specific material without unacceptable compromise to performance quality. If there is no likely viable substitute the material is considered critical to smartphone functionality. This criterion helps Fairphone to understand how critical the material is for the smartphone's functionality, and if opportunities exist to substitute for another less harmful, more sustainably-produced, or more abundant material. This is particularly important if the material is associated with many issues and/or is scarce in supply. Note that while some materials achieve a low score according to their general substitutability, when considered in relation to their use within micro electronics many of these scores increase due to the highly specialised functions that they perform. These scores now reflect these modifications.

Sources:
Graedel, T.E., et al (2015) "On the materials basis of modern society," 112(20) PNAS; Tercero Espinoza, L. A., et al (2015) "Substitution of Critical Raw Materials," CRM_InnoNet.

End-of-life recycling rates (EOL-RR)

% recycled from end of life post-consumer waste
Low: 0 ≤ 1
Moderate: 1 < % ≤ 35
High: 35 < % ≤ 50
Very high: > 50

This criterion represents the current global recycling rates of each material from post-consumer electronic waste. Low rates for this criterion means that there are for example no economic drivers or techniques currently available for recycling. This criterion helps Fairphone understand whether there is potential to increase recycling. Other barriers, such as limited collection opportunities might still hinder initial progress.

Sources:
Buchert, M., at al (2012) "Recycling critical raw materials from waste electronic equipment," Oko Institut e.V.

Potential to recycle from electronic waste

Low = unfeasible
High = feasible, but currently restricted by scale
Very high = feasible

This criterion describes the estimated potential to extract a specific material from electronic waste. Some materials are often used in combination with others, or in very tiny quantities, which makes it more difficult to extract them from waste. This criterion helps Fairphone to understand if it is feasible to improve recycling rates of materials from post-consumer WEEE. It is important to note here that although feasibility takes into account cost and energy efficiency, for a recycling initiative to be successful it also requires an adequate infrastructure in place to collect and sort materials, as well as economic incentive for recyclers. So even when it would technically be feasible to extract materials from electronic waste, the viability of recycling from components depends on the collection of a critical quantity of devices to extract small amounts of the target material. Given the miniaturization of electronic devices many devices are required, thus creating a barrier to achieving market scale.

Source:
"Study into the feasibility of protecting and recovering critical raw materials," European Pathway to Zero Waste, 2011.

Estimated depletion rate

Low = depletes > 1000 years
Moderate/High = depletes 100-1000 years
Very high = depletes < 100 years

This criterion describes if the material is likely to become unavailable from mining in the coming years. This criterion helps Fairphone to better understand where improving recycling rates and promoting a circular economy is most urgent and could have the most immediate impact. Note that this depletion rate is primarily determined by economic scarcity since very few materials can be considered truly scarce in the physical sense.

Sources:
Henckens, M.L.C.M., (2016) "Managing raw materials scarcity," Optima Grafische Communicatie, Rotterdam, The Netherlands.

Proportion of global production from artisanal & small-scale mining (ASM) by %

Low: 0 < 5
Moderate: 5 ≤ % < 15
High: 15 ≤ % < 25
Very high: ≥ 25

Estimated according to the proportion of global production putatively derived from ASM. In general the greater the level of ASM, the more likely the material can be associated with serious environmental and human rights issues. This study acknowledges that much has been achieved in recent years toward improving the capacity of ASM and developing best practice frameworks for responsible ASM, such as Fairtrade, Fairmined and the Diamond Development Initiative. We also acknowledge that some minerals can become associated with these issues at subsequent stages of the supply chain, such as recycling post-consumer waste, or 'urban mining.' However the scale of unregulated ASM remains so large that at this level of analysis it remains an appropriate indicator for a large proportion of the associated issues mentioned. Several peer-reviewed articles suggest that the % of ASM mining associated with the production of some materials in China is very high, including antimony, aluminium and zinc. However due to lack of supporting literature they have not been reflected here.

Sources:
Industry reports e.g. Tin for Tomorrow Report (2012) ITRI; The Emerging Cobalt Challenge, (2016), RCS; How can business contribute to the ethical mining of conflict minerals? (2014) BSR. Shen, L., & J. Gunson, (2006) The role of artisanal and small-scale mining in China's Economy, Journal of Cleaner Poduction, 14, pp. 427-435.

Association with conflict

Low: not currently included
Moderate: associated with the extraction of another ‘conflict mineral’
High: under consideration
Very high: defined by legislation

This criterion currently only encompasses the legally defined conflict minerals according to the Dodd-Frank Act, together with cobalt and copper which are under consideration as conflict minerals due to their association with conflict in the DRC. We recognize that conflict can have a wider definition and that more minerals can be associated with conflict especially when considered in their specific country context (see for example the report by, Ten Kate. G. and Scheele, F. (2015) There is more than 3TG, SOMO paper). We will keep this in mind and continue to add to this list in the future.

Source:
Section 1502 Dodd-Frank Act, 2012.

Association with radioactive waste

Estimated according to whether the material in question is likely to be found together with Naturally Occurring Radioactive Materials (NORM) in the same geological deposits. This creates risk if mine waste is not managed and stored responsibly.

Sources:
Naturally Occurring Radioactive Material (NORM VI) Symposium, IAEA, 2010; World Nuclear.

Association with water and/or soil pollution

Estimated according to whether the material in question is likely to be found in acidic sulfide ores. This creates risk if mine waste is not managed and stored responsibly. Unmanaged acidic discharge from mines creates further contamination risk by leaking toxic heavy metals (such as copper and nickel) into local soil and water systems.

Source:
USGS Mineral Commodity Summaries, Yearbooks & Fact Sheets.

Association with usage of toxic chemicals known to have significant impacts

Estimated according to prevalence of mercury and cyanide usage in unregulated mining environments, which have known potential to cause serious environmental and health hazards due to volume of use, high toxicity and tendency for bioaccumulation (persistence in the environment.) While most processing of ores requires some degree of chemical usage, many of which are potentially harmful, most are used in low concentrations or do not persist in the environment. In these cases risk is derived from accidental spillages rather than usage, and not considered here.

Sources:
Multiple, including Global Mercury Partnership.

Association with significant threats to biodiversity

Estimated according to average proximity of mines to protected areas (from strict conservation zones and national parks to areas of significant interest). Also considers those that impact on marine systems and arid areas with stressed watersheds.

Sources:
Multiple, including Kobayashi, H., Watando, H., and Kakimoto, M., (2014) "A global extent site-level analysis of land cover and protected area overlap with mining activities as an indicator of biodiversity pressure," Journal of Cleaner Production, 84, pp459-468; Miranda, M., et al (2003) "Mining and critical ecosystems: mapping the risks," World Resources Institute.

Relative association with high CO2 emissions

All metals are associated with high levels of greenhouse gas emissions compared to the production of other kinds of materials, so this study only categorises association with high emissions relative to other metals considered here. Different metals create high emissions at different stages of extraction and processing but at this level of analysis no differentiation has been made between different stages of the material life cycles.

Sources:
Multiple, including Rankin, J. "Energy use in metal production," presentation in High Temperature Processing Symposium 2012.

Association with serious health problems

Estimated according to whether the material in question is mined from ores known to generate hazardous airborne pollutants if not managed responsibly, including (but not limited to) silica, nickel, beryllium, cadmium, lead, cobalt and radons. Inhalation of metallic and mineral dusts can directly cause a variety of respiratory illnesses (silicosis, tuberculosis, pneumoconiosis; bronchitis, heavy lung disease) as well as cancers and heart problems.

Sources:
Multiple, including Chen, W., et al (2012) "Respiratory Diseases Among Dust Exposed Workers," Department of Occupational and Environmental Health, School of Public Health, Tongji Medical College in Huazhong University of Science & Technology, China.