20 CASE STUDY: THE DIGITAL DEVICE LIFE CYCLE: FROM MINING TO E-WASTE

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ABSTRACT

The world's appetite for digital devices has significant economic, social and ecological consequences for developing countries. It is contributing to a mining boom and shifting manufacturing. While this demand offers potential economic growth for low- and middle-income countries – the source for many of the raw materials for ICT products – mining jobs are often precarious and unsafe. ICT products in turn contribute to the world's growing streams of hazardous e-waste, for which low- and middle-income countries are often the dumping ground. Governments with minerals in high demand for ICTs should leverage their position to maximise the economic benefits. Regulation of e-waste recycling is also necessary to combat health and safety risks.

Key messages

- Increased demand for digital devices has contributed to a global mining boom. This boom holds potential economic gains in developing countries, but is contributing to pollution, e-waste and increasing demand for land.
- Development partners and host governments should focus on maximising the benefits for development, including tax arrangements, local content provisions and investing in the capacity of the local workforce, as well as increased oversight of the e-waste recycling industry.

Managing the ripple effects of non-stop global demand for digital devices

Digitalisation is creating an ever-growing appetite for digital devices, and that demand is creating ripple effects across low- and middle-income countries. Many of these information and communication technologies (ICTs) and products use metals that are extracted largely in countries where regulation is uneven, are manufactured in places where worker protections are still weak, and eventually get discarded in ever-growing streams of untreated hazardous e-waste. While this increased demand is fuelling growth, developing country governments also are grappling with its far-reaching economic, social and environmental consequences: how to manage revenues from the resulting mining boom, ensure that the benefits are sustainable through safe and meaningful jobs, and avoid becoming the dumping ground for the e-waste left behind.

Demand is fuelling hard-to-manage growth in metals-mining countries

A typical smartphone contains 15 different metals, including lithium-ion batteries, copper wiring and gold that is used in circuit boards. Many other metals now used in ICTs, among them rare earth metals, are being used on a significantly larger scale than ever before (UNCTAD, 2020[1]). Demand for products such as ICT devices and renewable energy has led to a new mining boom in Africa since 2000 (Bezzola, 2020[2]). For many countries, mining is an economic blessing. Seven metals primarily used for ICTs (including indium and tantalum) contribute 68% of the total value of all metals produced in Rwanda, 23% in Burundi, and 15% in Ethiopia (UNCTAD, 2020[1]). Further, since 2000, resource-rich countries in Africa have had, on average, about 60% higher economic growth than other African countries (Chuhan-Pole, Andrew and Land, 2017[3]; Bezzola, 2020[2]). However, this ICT-driven mining boom is not without significant economic, environmental and social risks, including pollution, lack of rehabilitation, increasing demand for land, hazardous working conditions, and conflicts between mining companies and local populations.

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Transparency and regulation can help ensure that mining fosters inclusive development. Many African governments relaxed mining regulations and granted generous tax holidays to attract foreign investment in the early 2000s (Campbell et al., 2004[4]). However, increasing mining did not always translate into better development outcomes (Gamu, Le Billon and Spiegel, 2015[5]). One reason is that regulatory frameworks tend to be weak in most low- and middle-income countries, resulting in weaker enforcement of even minimal standards and making it less likely that society benefits from resource wealth (Natural Resource

Governance Institute, 2017[6]). A recent survey of 81 jurisdictions shows that only 19 – with Ghana the sole African country among them – have governance frameworks and procedures in place that make it likely that citizens benefit from extractive resource wealth (Natural Resource Governance Institute, 2017[6]).

Managing mining revenues can also be overwhelming for capacity-constrained tax administrations, and proceeds from mining can be vulnerable to capture by political elites. The Extractive Industries Transparency Initiative[1] is the most established and widely supported policy initiative to curb corruption in the extractive sector. In addition to mine-level reconciliation of tax information provided by companies and tax authorities, the initiative now requires disclosures along the value chain: starting with licensing and beneficial ownership on to extraction, production and exportation, and including information on how revenue makes its way to the government and how revenues are managed and distributed, including to the subnational level.

In artisanal mining, certification schemes such as Fairtrade Gold[2] and Fairmined[3] foster responsible production and improve traceability. Increasing the supply of certified metals is limited by ill-defined regulatory frameworks for artisanal miners in the host countries and low demand and willingness to pay by consumers. However, increased due diligence, such as disclosing the provenance of metals, can result in companies withdrawing entirely from areas with a high risk of conflict or of widespread or serious human rights abuses, which also jeopardises the livelihood of all workers in these areas. Other initiatives focus on formalising and monitoring artisanal mines, among them the United Nations Minamata Convention,[4] the most extensive international effort to formalise the artisanal (gold) sector.

While mining provides jobs, these are often semi-skilled, unsafe and precarious

Alongside the increased demand for metals used in ICT products, the mining industry is undergoing a digital transformation of its own. Mechanising repetitive work can bring down costs. At the first fully automated mine in the world, the Syama gold mine in Mali, for example, costs have been reduced by 30% (Bongaerts, 2019[7]). But the shift to automation will also reduce the demand for semi-skilled labour in a sector where, at the mine site level, resettlement, pollution and unmet expectations regarding jobs already frequently lead to conflict and civil unrest. Corporate social responsibility initiatives tend to be motivated by the company's own interest, though recent approaches like the Resource Impact Dashboard[5] are focused on holistically monitoring development trends in industrial mining areas and bring mining companies together with local people and governments to foster evidence-based decision making.

Outside the formal mining sector, the poorest find work in artisanal mining that extracts many metals used in ICTs such as gold and tantalum. The number of people involved in this dangerous and strenuous work has increased dramatically, from an estimated 6 million in 1993 to 44.7 million in 2021 (Delve, 2021[8]). However, due to the high level of informality and despite initiatives such as the open-source data-sharing platform Delve,[6] very limited disaggregated data on artisanal mining are available. While research suggests that artisanal mining has a significant potential to alleviate poverty, the sector also is associated with a range of serious environmental and social concerns, including pollution, deforestation, hazardous working conditions and the use of child labour (Swenson et al., 2011[9]). A large percentage of artisanally mined metals is exported through illicit channels without being taxed and used to launder money or even finance armed groups (OECD, 2018[10]).

Manufacturing is shifting to new countries to meet global demand

Manufacturing to satisfy the exploding demand for digital products is expanding

to new countries, prompting concern that safe working conditions and workers' rights may not be protected. Electronics manufacturing has extended beyond traditional centres such as the People's Republic of China, Korea and Thailand to Cambodia, Indonesia and Viet Nam, among others. Firms in these countries face frequent criticism over conditions for their workers, including exposure to harmful chemicals, low wages and denial of the right to unionise. Similar to the civil society initiatives focused on improving conditions in the garment industry, campaigns such as Make It Fair[7] and Electronics Watch[8] are pressuring electronics firms to commit to more sustainable production and urging governments to do more to protect the rights of workers in electronics supply chains (Evans and Vermeulen, 2021[11]).

Though most of the value creation from the extraction of metals used for ICTs comes from processing and manufacturing, the low-income countries where such mining occurs remain mainly exporters of unprocessed raw materials. Building the capacity for such activities will require an expansion of vocational training and tertiary education as well as the introduction of industrial policies that promote value addition. Botswana followed such a strategy for the diamond industry (Maennling and Toledano, 2018[12]) and could serve as a model for other countries.

E-waste from ICTs is predominantly ending up in developing countries, where capacity for safe recycling is low

Once in the hands of consumers, digital devices and ICTs have short lifespans – discarded and replaced quickly because they tend to be fragile, difficult or impossible to repair, and often rendered obsolete as newer models or devices are developed. This rapid turnover for digital products is contributing to e-waste – hazardous waste containing heavy and toxic metals – that is one of the world's fastest-growing waste streams (Lundgren, 2012[13]).

About 53.6 million metric tonnes (Mt) of e-waste, or 7.3 kilogrammes (kg) for every person in the world, were generated in 2019 (Forti et al., 2020[14]). The e-waste volume had grown at a rate of approximately 21% in the five years before 2019; by 2030, as much as 74.7 Mt per year could be generated (Forti et al., 2020[14]; WHO, 2021[15]). Although Asia produced the most e-waste overall in 2019, it also accounts for a large share of the world population, and thus it produces a lower amount of e-waste per capita (5.6 kg per person) than Europe (16.2 kg per capita), Oceania (16.1 kg per capita) and the Americas (13.3 kg per capita) (Forti et al., 2020[14]).

Only 17.4% of all global e-waste is formally recycled. The amount recycled varies widely across regions, ranging from less than 1% of e-waste in Africa to 43% in Europe (Forti et al., 2020[14]). The fate of the rest of the e-waste is largely undocumented. While most was probably mixed with other waste streams and not optimally treated, an estimated 7-20% was shipped illegally to low-income countries, according to research by Forti et al. (2020[14]). Although exporting e-waste is prohibited under the Basel Convention, the researchers said it is still done by falsely labelling the e-waste as scrap metal or devices intended for reuse.

There exist, however, potential opportunities in e-waste, which is a rich source of secondary metals. The value of raw materials embedded in the 53.6 Mt of e-waste generated in 2019, for instance, is estimated at about USD 57 billion (Forti et al., 2020[14]). Integrated interventions to promote responsible recycling practices on the part of producers and consumers could capture these metals and reintroduce them into formal supply chains.

Low-income countries now lack the technical capacity to safely recycle e-waste, which leads to dangerous contaminants flowing to local communities and environments (Wang, Zhang and Guan, 2016[16]; Awere et al., 2020[17]). While capacity-building initiatives such as the Sustainable Recycling Initiative[9] are supporting

sustainable e-waste processing, most e-waste in low- and middle-income countries are not safely treated. As the World Health Organization noted in a recent report, millions of people, including 13 million women and children as young as 5 years old, work in the informal waste sector, and the toxic environments created by e-waste are particularly harmful to children, who absorb more toxic elements than adults (WHO, 2021[15]).

Producers are being encouraged to design modular devices that are easier to repair and dismantle for recycling and to design devices to handle more software updates. Governments can implement regulations that limit waste generation and require businesses that manufacture, import and produce products to be responsible for the waste these products create. An example is the proposed "right to repair" legislation in the United States and Europe. Recycling initiatives in low- and middle-income countries should also not exclude informal waste workers, but give them the necessary tools and training to do their work safely. Consumers can reduce e-waste inflow by using devices for longer, repairing broken devices and only then recycling those beyond repair. Given the environmental costs of mining, and the advantages of not generating more e-waste, recovering unused or old devices from consumers can be cost-effective (Corwin, 2019[18]; Van der Merwe and Günther, 2020[19]).

Development co-operation can help manage repercussions of growing demand

Demand for digital products will only increase as more economic and social activities are digitalised. Development co-operation actors have an important role to play to help low- and middle-income countries – the source for many of the raw materials for ICT products and often the dumping ground for the e-waste these products create – manage the consequences of this boom. Support for capacity building, for example, can help governments maximise and beneficially manage revenues from the mining of metals needed for digital devices; develop regulatory frameworks to ensure safe working conditions in mining and manufacturing; and safely, and even profitably, deal with e-waste.

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The digitalisation boom's demand for primary resources gives leverage to governments of countries with minerals that are much in demand. Development partners and host governments should focus on negotiating licensing conditions that maximise the benefits for development, including tax arrangements and local content provisions. Another important area is technical support to agencies mandated to enforce existing social and environmental regulations, including by investing in the capacity of the local workforce and exploring the potential of industrial clusters.

Finally, there is a need to increase the oversight of the recycling industry by implementing e-waste standards, collaborating and synchronising initiatives from all private and public groups, including non-governmental organisations, businesses, local governments and the informal recycling industry.

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NOTES

1. For more information on the initiative, see: https://eiti.org.
2. For more information, see: https://fairgold.org/#:~:text=Fairtrade%20Gold%20is%20sourced%20exclusively,Minimum%20Price%20for%20their%20product.
3. For more information, see: https://fairmined.org and https://www.responsiblemines.org/en.
4. For more information on the convention, see: https://www.mercuryconvention.org.
5. For more information, see: www.resource-impact.org.
6. For more information on the platform, see: https://delvedatabase.org.
7. For more information on the project, see: https://www.themakeitfairproject.com. https://www.themakeitfairproject.com/
8. For more information on the initiative, see: https://electronicswatch.org/en.
9. For more information on the initiative, see: https://www.sustainable-recycling.org.

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