

1 Green IT

Jacques Mock Schindler

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Green IT: The Environmental Footprint of Information Technology—With a Focus on Coltan Conflicts

Key Takeaway:

The environmental footprint of IT extends far beyond energy use and e-waste. It includes hidden social and ecological costs, such as violent conflicts over minerals like coltan, which are essential for our digital devices. Understanding these indirect costs is crucial for making technology more sustainable.

Introduction: What Is the Environmental Footprint of IT?

The environmental footprint of IT encompasses the entire lifecycle of devices and services—from raw material extraction and manufacturing to usage and disposal. This footprint is typically divided into three main areas: the environmental costs of hardware, the costs of computing, and the indirect costs, which include the often-overlooked consequences of resource conflicts such as those surrounding coltan.

Environmental Costs of Hardware

IT hardware—computers, smartphones, servers—has a substantial environmental impact, primarily through three channels: **transport**, **mining**, and **construction**.

Transport

The globalized nature of IT manufacturing means that raw materials are sourced from around the world, assembled in countries like China, and shipped to consumers everywhere. This complex supply chain results in significant greenhouse gas emissions from international shipping and logistics.

Mining

Mining for essential minerals, such as copper, lithium, and especially coltan (columbite-tantalite), is one of the most environmentally damaging aspects of IT hardware production. Coltan is crucial for producing tantalum capacitors, which are found in nearly all smartphones and laptops. Mining operations often lead to deforestation, water pollution, and the destruction of habitats for endangered species. In the Democratic Republic of the Congo (DRC), for example, coltan mining has contributed to the loss of 8.6% of the country's tree cover since 2000 and has devastated populations of gorillas and other wildlife.

Construction

The manufacturing process for IT devices is energy-intensive and relies on hazardous chemicals. Factories often use fossil fuels, contributing to global warming. The short lifespan of many devices leads to frequent replacement, increasing demand for new resources and generating vast amounts of electronic waste (e-waste). Globally, only about 22% of e-waste is properly recycled, with the rest ending up in landfills or being processed under unsafe conditions.

Environmental Costs of Computing

Beyond hardware, the operation of IT systems—especially data centers and networks—has a major environmental impact.

Energy Consumption

Data centers, which store and process digital information, are among the largest consumers of electricity worldwide. In 2024, data centers accounted for about 1.5% of global electricity use, a figure expected to rise with the growth of artificial intelligence and cloud computing (such as running Jupyter notebooks online). The IT sector as a whole is responsible for 3–4% of global greenhouse gas emissions.

Power Usage Effectiveness (PUE)

This metric measures how efficiently a data center uses energy. Lower PUE values indicate more efficient operations.

Green Data Centers

To reduce their environmental impact, many organizations are investing in green data centers. These facilities use renewable energy sources, advanced cooling systems, and waste heat recovery to minimize energy use and emissions.

Swiss Example

The [Green Data Center Zurich](#) supplies waste heat to over 1,000 households, demonstrating how digital infrastructure can support local energy needs while reducing waste.

Sustainable Software

Software also plays a role in energy consumption. Efficient code and algorithms can reduce the amount of computing power required, lowering both energy use and emissions. Sustainable software development focuses on optimizing applications to use fewer resources and extend the lifespan of hardware.

Indirect Environmental Costs: The Case of Coltan Conflicts

The indirect costs of IT are often less visible but can be even more severe than direct environmental impacts. One of the most significant examples is the conflict over coltan in the DRC.

Coltan: A Critical Mineral with a Heavy Toll

Coltan is essential for the production of tantalum capacitors, which are used in almost every modern electronic device. The DRC holds up to 70% of the world's coltan reserves, making it a key player in the global supply chain. However, the extraction and trade of coltan have fueled violent conflicts, human rights abuses, and environmental destruction.

Conflict and Human Rights in the DRC Mining Sector

Violence and Displacement The security situation in eastern DRC remains critical as armed groups, most notably the M23 rebels, have consolidated control over strategic coltan mining hubs like Rubaya to [finance their military operations](#). This conflict has fueled a humanitarian catastrophe; as of early 2026, the number of internally displaced persons has reached a staggering [7.3 million people](#), while estimates from human rights monitors suggest that [thousands of civilians](#) continue to be killed annually in related violence and territorial disputes.

Child Labor and Exploitation The artisanal mining sector continues to rely heavily on exploitation, with an estimated [40,000 children](#) working in hazardous conditions in the DRC's mines for poverty wages. Beyond child labor, international observers like [Amnesty International](#) have documented systemic human rights violations, including forced evictions of local communities and widespread sexual violence against women and children, highlighting the devastating human cost of the global demand for cobalt and coltan.

Economic and Environmental Impacts

Resource Curse Despite the DRC possessing vast mineral wealth, the “resource curse” remains a stark reality: over [70% of the population](#) continues to live on less than \$2.15 a day. While the global demand for electronics drives high prices for coltan, most artisanal miners earn only a few dollars per day, with the vast majority of profits being siphoned off by [armed groups and corrupt officials](#) to sustain ongoing conflicts.

Environmental Destruction The expansion of unregulated mining has led to catastrophic environmental consequences. According to [UNEP reports](#), mining operations have driven large-scale deforestation in the Congo Basin, contaminated local water sources with heavy metals, and destroyed critical wildlife habitats. These ecological damages create long-term indirect costs that far outweigh the immediate economic gains from mineral extraction.

Global Supply Chain Challenges

- **Smuggling and Fraud:**

Coltan from conflict zones is often smuggled into neighboring countries and mixed with legally sourced minerals, making it difficult for manufacturers to trace origins and avoid complicity in human rights abuses.

- **Certification and Regulation:**

International efforts, such as the OECD Due Diligence Guidance, the Dodd-Frank Act in the US, and the EU Conflict Minerals Regulation, aim to improve supply chain transparency. However, enforcement is weak, and certification schemes have been undermined by fraud and lack of oversight.

Key Finding

The true cost of our digital devices includes not only environmental degradation but also the perpetuation of conflict and human suffering in mining regions.

Table: Main Environmental and Social Impacts of IT

Area	Main Impacts	Solutions/Trends
Hardware	Mining, transport, e-waste	Circular economy, sustainable sourcing
Computing	High energy use, emissions	Green data centers, efficient software
Indirect	Conflict, human rights abuses, environmental destruction	Policy, responsible sourcing, consumer awareness

Further Reading:

- [Amnesty International: “This is what we die for”](#)
- [OECD Due Diligence Guidance](#)
- [UN Reports on DRC](#)