Lifecycle Analysis of Mobile Phones and E-Waste Implications

Your Name, Institution

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The rapid turnover of mobile phones has transformed communication, but it has also generated one of the most pressing environmental challenges of the 21st century, which is electronic waste (e-waste). Mobile devices, which often have a usage lifespan of only two to three years, are replaced frequently due to technological obsolescence and consumer trends. Each stage of a phone's lifecycle (from raw material extraction and manufacturing to distribution, use, and disposal) contributes significantly to environmental degradation and greenhouse gas emissions. This project aims to analyze the lifecycle of a modern smartphone, quantify its carbon footprint, identify the stages with the greatest environmental impact, and propose practical measures to reduce e-waste and extend device longevity. The motivation stems from the growing recognition that sustainable hardware management is essential for achieving circular economy and climate targets.

1 Related Work

Numerous studies and policy documents highlight the growing magnitude of e-waste and the specific challenges associated with mobile devices. The *Global E-waste Monitor 2024* by the United Nations estimates that more than 5 billion mobile phones were discarded in 2023, with only a fraction recycled properly. The European Commission's *Right to Repair* initiative emphasizes the importance of repairability and standardized components to reduce waste. Life Cycle Assessment (LCA) studies [1, 2] have demonstrated that the extraction of rare metals (e.g., cobalt, lithium, and gold) and the manufacturing phase are responsible for most of a smartphone's environmental burden. Slovenian reports by ARSO on e-waste management also show that while collection rates are improving, the reuse and refurbishment rates remain low. These works collectively reveal the urgent need for more effective interventions at both consumer and policy levels.

2 Methodology

This project will perform a lifecycle analysis (LCA) of a mid-range smartphone model. The analysis will cover four stages: (1) resource extraction, (2) manufacturing and assembly, (3) use phase, and (4) end-of-life processing. Data will be sourced from UN and EU reports, manufacturer disclosures, and academic LCA databases. Carbon footprint estimations will be based on established methodologies such as those in the Global E-waste Monitor and peer-reviewed LCA literature. The project will also estimate global device turnover, average usage duration, and material recovery rates. The following table outlines the main tasks:

Task	Description
Device selection	Select a representative smartphone model for analysis.
Lifecycle mapping	Define stages: extraction, manufacturing, use, and disposal.
Data collection	Obtain quantitative data from LCA studies and environmental databases.
Carbon footprint estimation	Calculate GHG emissions per device and per lifecycle stage.
Recommendations	Propose strategies for footprint reduction and improved recycling.

3 Milestones

The proposed project timeline is as follows:

- **17.10.2025** – Submission of project proposal
- **05.11.2025** – Completion of literature review and lifecycle framework
- **26.11.2025** – Data collection and preliminary carbon footprint calculation
- **19.12.2025** – Draft of recommendations and rebound effect analysis
- **12.01.2026** – Submission of final project report

4 Evaluation Plan

The project's success will be evaluated based on the comprehensiveness and accuracy of the lifecycle model, the reliability of data sources, and the quality of the environmental impact analysis. Quantitative metrics, such as total CO_2 equivalent emissions per smartphone, will support the evaluation. Qualitative assessment will focus on the originality and feasibility of proposed interventions—such as extending device lifespans, promoting modularity, and enhancing user awareness. The evaluation will also consider how the project aligns with relevant UN Sustainable Development Goals (SDGs), particularly SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).

5 Resources

Key resources include the *Global E-waste Monitor* (UN, 2024), European Commission's "Right to Repair" policy reports, and ARSO (Slovenia) national data on e-waste management. Academic databases providing LCA data, such as Ecoinvent and SpringerLink, will be used for numerical estimations. Access to institutional library resources and data visualization tools will be required for analysis and presentation.

References

[1] Linhart, P. (2014). *Life Cycle Assessment of Electronic Products: A Case Study on Mobile Devices*. Environmental Research Journal.

[2] Linhart, P. (2008). *Environmental Impacts of ICT Devices*. Journal of Sustainable Technology.

[3] UN (2024). *Global E-waste Monitor 2024*. United Nations University.

[4] European Commission (2023). *Right to Repair Initiative*. EU Sustainable Consumption Programme.