Digitalisation and Natural Resources

Analysis of the resource intensity of the digital transformation in Germany
Project No. (FKZ): 3720 31 101 0, 3724 31 7030
Project runtime: 2020 - 2027

How will digitalisation affect the consumption of natural resources?

Diverse aspects of our private and professional lives are increasingly shaped by digital technologies. This **transformation** holds significant potential for the economy, society, and the environment. Digitalisation enables the development of new products and services, enhances process efficiency, and can ultimately contribute to conserving natural resources. However, there is a pressing need to improve our understanding of how digitalisation itself influences the demand for energy and natural resources – such as copper, plastics, specialty metals, or rare earth elements – as well as its contribution to greenhouse gas emissions.

This gives rise to a range of **research questions**: To what extent does digitalisation increase resource demand? How does it affect consumption patterns in society? How can national policymakers ensure that globally distributed digital services operate in an environmentally responsible manner? What strategies can guide the digital transformation towards reduced resource use and lower greenhouse gas emissions?

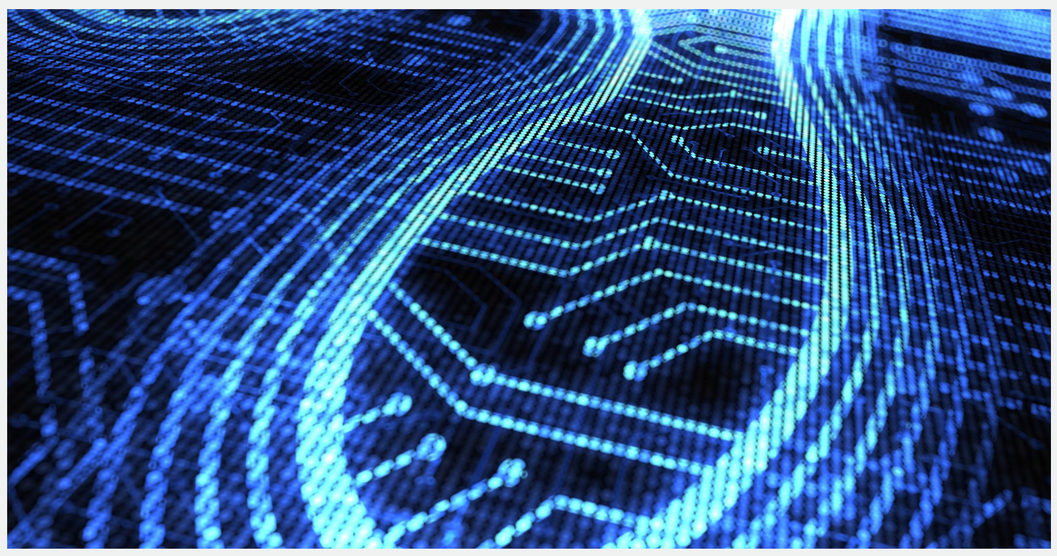

Fig. 1: The significant material footprint of digitalisation needs to be better understood.
Source: iStock (Image credit: alengo)

The research project

The German Environment Agency investigates these and other questions with the research project Digitalisation and Natural Resources (*DigitalRessourcen*) and analyses the impact of digitalisation on natural resources in Germany. The first phase of the research project started in fall of 2020 and ran until 2023. Phase II, running from 2025 to 2027, is being carried out by the Institute of Economic Structures Research (GWS), Ecologic Institute and Wuppertal Institute.

The approach

In Phase I of the project, the German Environment Agency (UBA) commissioned an assessment of the resource intensity and greenhouse gas emissions associated with the digital transformation, conducted at both micro and macro levels. **Ten case studies** applied life cycle assessment (LCA) methodology to quantify the resource intensity of specific digital applications and determine their ecological footprints.

At the macro level, a **multi-regional input-output (MRIO) model** was used to calculate raw material consumption, material inputs, and the carbon footprint of the ICT sector from the year 2000 onwards. The model also projected developments under seven scenarios through to 2050.

Findings from the simulations and case studies informed initial policy and action recommendations for promoting a resource-efficient digital transformation.

Phase II of the project, places a strong emphasis on **stakeholder engagement.** This phase includes a stakeholder survey, analysis, and two central workshops, aimed at refining key areas of action and developing more specific policy recommendations.

The analytical component of DigitalRessourcen II will comprise five additional case studies, including studies focused on **artificial intelligence.** It will also feature macroeconomic and mesoeconomic modelling for certain **fields of demand and sectors**.

Phase II (2025 – 2027)

Stakeholder survey and analysis for strategic project alignment and information gathering

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Implementation of five additional **case studies** on life cycle data of digitalization products and services (analogous to Phase I)

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Updating and deepening of the **macroeconomic calculations** from Phase I (Items 3 & 4)

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Stakeholder dialogue to refine fields/measures for action and to discuss and reflect on the results

Fig. 2: Phase II of the research project *DigitalRessourcen*

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