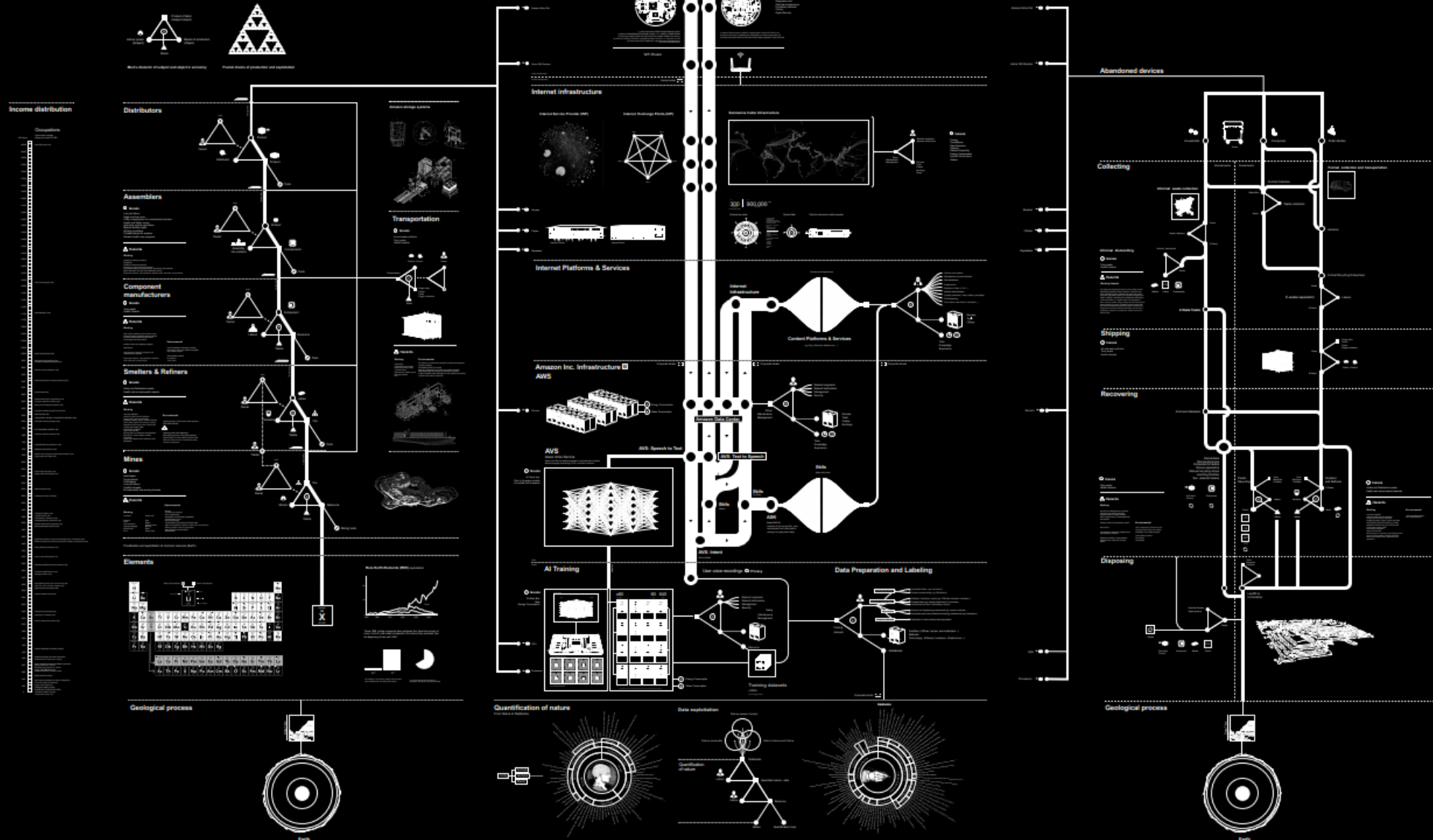


Submarine Cable Infrastructure



Anatomy of an AI system

An anatomical case study of the Amazon echo as an artificial intelligence system made of human labor



Source: <https://anatomyof.ai/>

(Digital) green tech – what is „green“ about it and how can we do it?

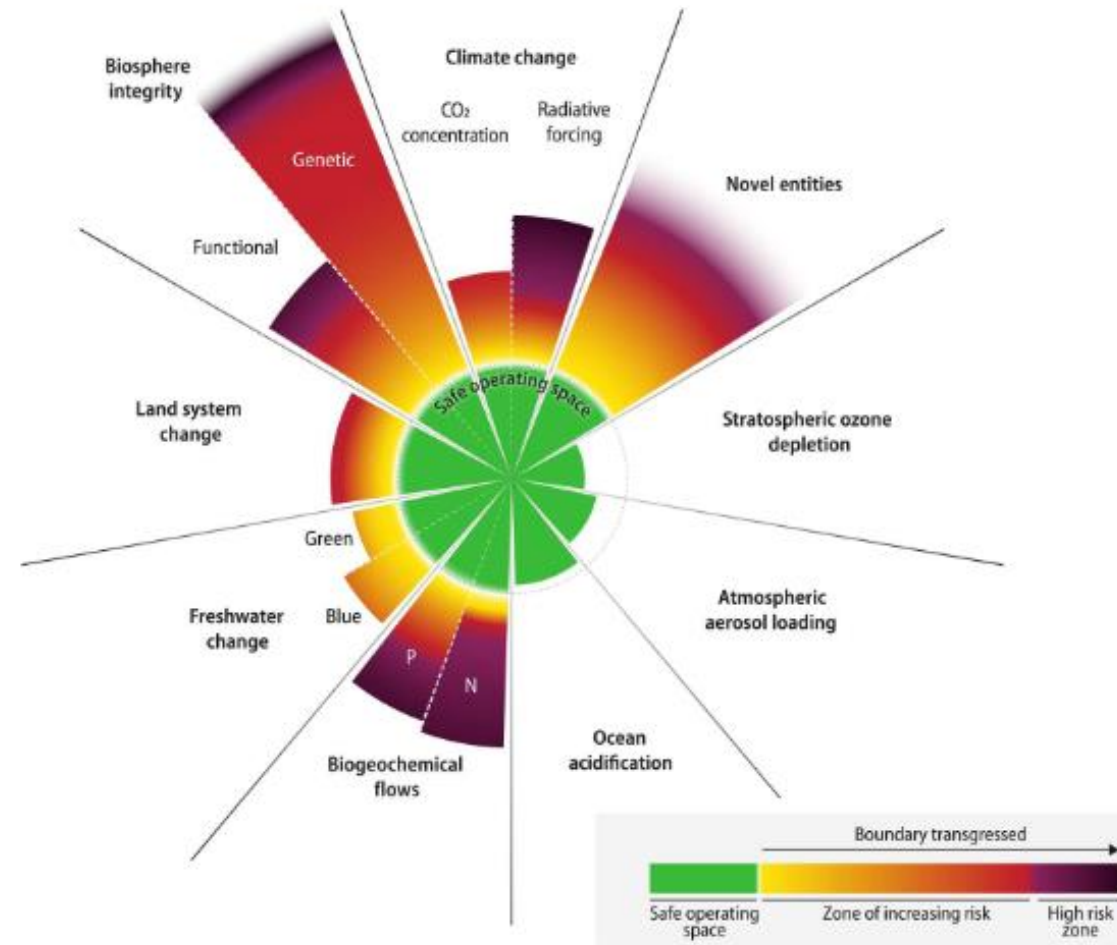
Dr. Stefanie Kunkel, Research Institute for Sustainability (RIFS) Helmholtz Centre Potsdam



Research Institute for Sustainability
Helmholtz Centre Potsdam



„Green“ - Facets of environmental sustainability



Status of „planetary boundaries“

Source: Richardson et al. (2023)

Two types of environmental effects of digital technologies

Direct environmental effects

Effects of the physical existence of digital technologies (along the lifecycle)

→ "Sustainability of digitalisation"

Indirect environmental effects

Effect of digital technologies' application in other economic sectors

→ "(Un-)Sustainability by digitalisation"

Source: Adapted from Berkhout & Hertin (2001) & Arnfalk et al. (2004)

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The amount of 82 million kg of electronic waste forecast for 2030 ([Global E-Waste Monitor](#)) corresponds to the weight of 16.4 million African elephants, each weighing 5,000 kg.



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Rebound-Effects

Energy efficiency \neq Energy conservation



Development of a „Green information and communication technologies (ICT) guideline“

Green ICT guideline: Achieving green digital technologies



Step 1: Inventory of the ICT system, definition of responsibilities

Step 2: Anticipation of possible environmental effects

Step 3: Selection of objectives and system boundaries

Step 4: Development of courses of action

Step 5: Implementation of the approaches

Step 6: Progress review, progress communication and iteration

Focus of our guideline

Green ICT guideline: 6 steps for green digital technologies

Step 1: Inventory of the ICT system, definition of responsibilities

Step 2: Anticipation of possible environmental effects

Step 3: Selection of objectives and system boundaries

Step 4: Development of courses of action

Step 5: Implementation of the approaches

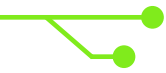
Step 6: Progress review, progress communication and iteration

Focus of our guideline



Inventory of the ICT system

- 1. IT Service**
- 2. Software**
- 3. Data centres**
- 4. Networks**
- 5. Hardware**



Green ICT guideline

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Table Anticipating environmental effects

Layer	What possible direct and indirect environmental effects could result from the inventory (step 1) in my innovation project/my organization?
general	<p>What are the already known environmental effects of the ICT system? How can the ICT system influence the need for energy production and use? What materials will be used to manufacture and operate the ICT system? What waste or emissions are produced in the manufacture of the ICT system? How can the use of the ICT system promote or impair the reuse or recycling of goods or parts of goods? How might the ICT system affect the plants or animals in its environment? Or elsewhere? How can it change the composition and use of the land around it? E.g. by occupying arable land? Or elsewhere?</p>
IT Service	<p>Does the operation of the ICT system require users to have certain hardware? Do the digital applications in the ICT system lead to behavioral changes among producers and/or consumers that could have environmental effects?</p>
Software	<p>Is the software open source, reusable, decentralized? (Source CommunityTech Guideline); Is the software efficient or unnecessarily energy-intensive? Does a software update require new hardware?</p>
Data centres	<p>Are the data centers powered by renewable energy? What environmental effects are disclosed by the operator?</p>
Networks	<p>Does the ICT system in the network lead to an increase or decrease in energy demand compared to the status quo? Does the ICT system require an expansion or modification of the existing network, which may lead to environmental effects (such as land use/displacement)?</p>
Hardware	<p>What environmental impact does the production of hardware have? Is the hardware powered by renewable energy? Is there a way to create incentives for this? How many years will the hardware be operated and what will happen to it afterwards?</p>

Source: This table builds on the SusAF framework ([Link](#))



Green ICT guideline

Step 1: Inventory of the ICT system, definition of responsibilities

Step 2: Anticipation of possible environmental effects

Step 3: Selection of objectives and system boundaries

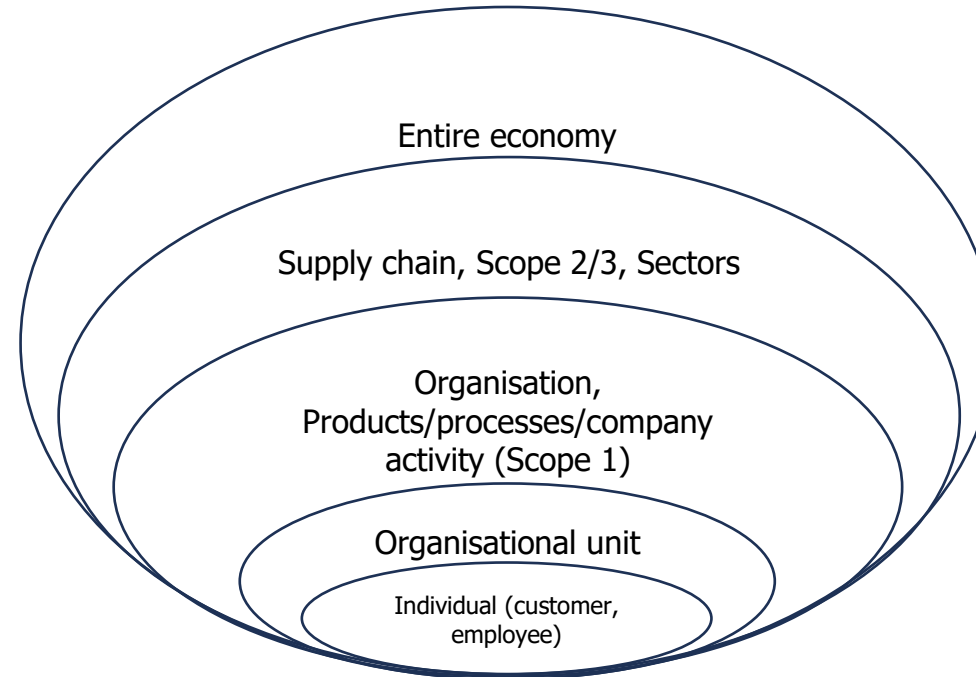
Step 4: Development of courses of action

Step 5: Implementation of the approaches

Step 6: Progress review, progress communication and iteration

Focus of our guideline

Anticipating possible chains of effects across system boundaries and deciding which aspects to address



Schematic representation of system boundaries



Chains of effects of digital technologies across system boundaries, e.g., when a digital technology is used along the supply chain



Green ICT guideline

Step 1: Inventory of the ICT system, definition of responsibilities

Step 2: Anticipation of possible environmental effects

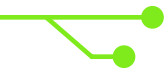
Step 3: Selection of objectives and system boundaries

**Step 4:
Development of
courses of action**

Step 5:
Implementation of the approaches

Step 6: Progress review, progress communication and iteration

Focus of our guideline



Measures for each layer

- 1. IT Services:** e.g., change default settings for customers to energy-saving modes
- 2. Software:** e.g., use energy-efficient programming languages and prevent hardware obsolescence
- 3. Data centres:** e.g., use environmentally certified data centre operators
- 4. Networks:** e.g., choose efficient and parsimonious transmission networks
- 5. Hardware:** e.g., use refurbished hardware

Thank you for your attention!

Contact



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Bundesministerium
für Wirtschaft
und Klimaschutz



GreenTech

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