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Materials Science and Technology

Updating LCA datasets of the ICT sector

Insights and intricacies when using public data

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84th LCA Discussion Forum, ETH Zentrum, Alumni Pavillon

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What's behind the use of smartphone?



Lack of consensus on ICT environmental impacts

Device, electronics, hardware “physical side”

INSIGHTS

Electronic Supply Chain
Industry research from the
Z2Data Team

According to [research](#) published by a group at Harvard in 2020, **hardware manufacturing is the dominant source of carbon emissions**. The research included reports on the biggest tech companies, including TSMC, Intel, Google, Microsoft, Facebook, and Apple.

As mentioned by [Schneider Electric](#), billions of chips are fabricated yearly, and production of one single chip requires approximately 32 liters of water, 2.5 oz of chemicals and 1.6kg of petroleum.

Data centers, networks, internet “cloud side”



BUSINESS | GLOBAL ISSUES

Data centers keep energy use steady despite big growth

Timothy Rooks
01/24/2022

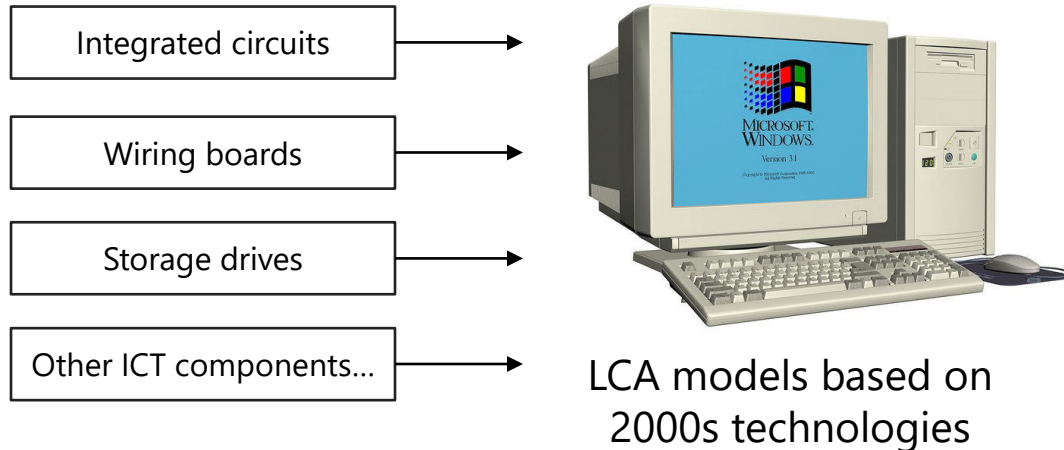
Data centers that support businesses, **internet services and our social media lives use lots of energy**. As their numbers grow there is pressure to make them more energy-efficient and reduce their environmental impact.

Context: ICT in LCA databases

1: Information and communication technologies

2007 : Ecoinvent 2.2+ / UVEK originally has ~120s datasets for ICT

2020s : Ecoinvent 3.9.1 has new datasets for ICT, but may lack updates on key electronic components and transmission network & infrastructure

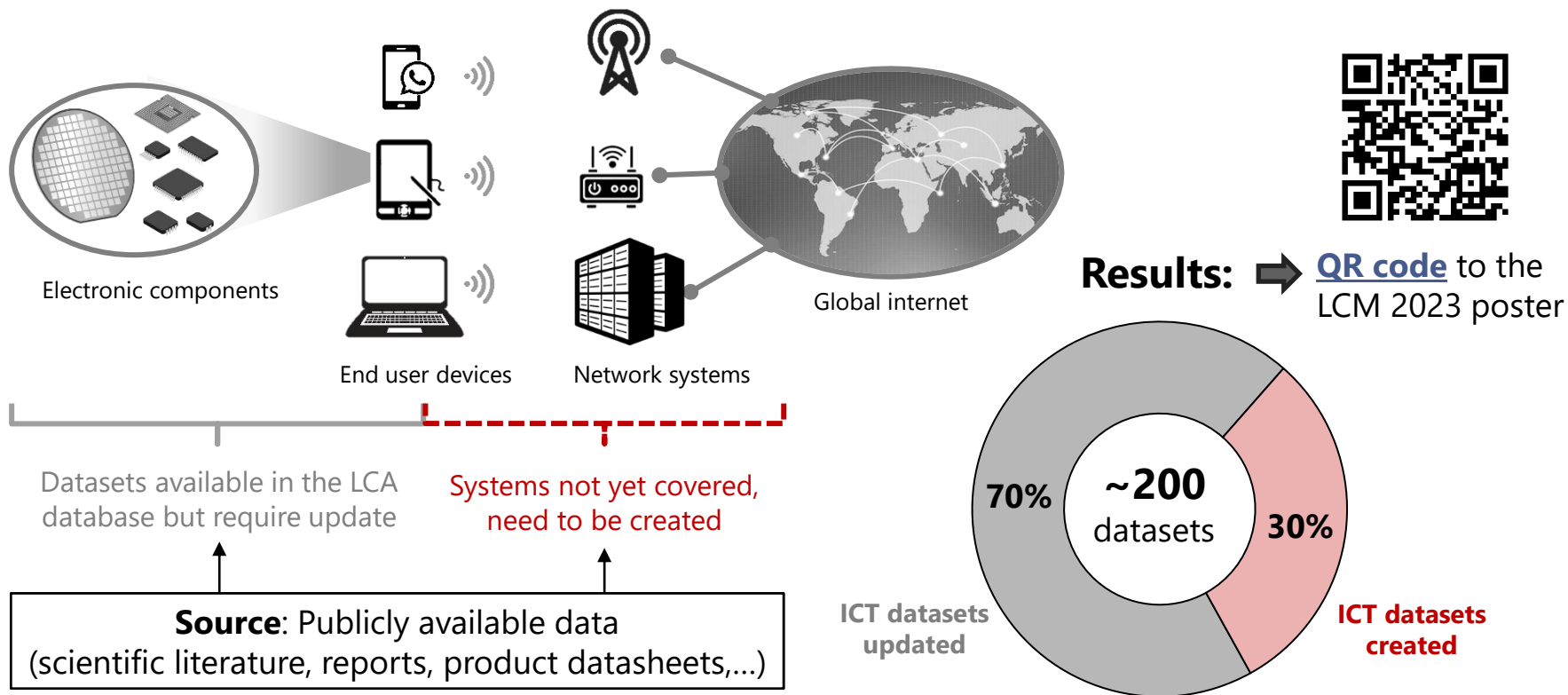


Open issues:

- Representation of today's technologies?
- Environmental hotspots for the ICT¹ sector?

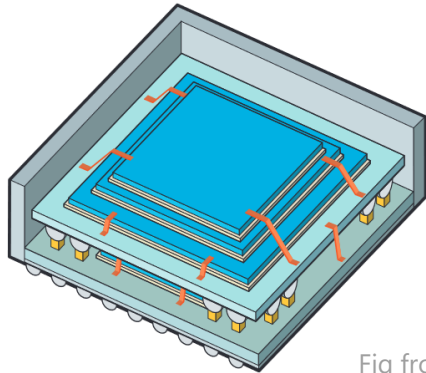
Modernizing ICT datasets in the UVEK² LCA database

2: Swiss UVEK LCA database is based on Ecoinvent version 2.2+



Some challenges when using secondary data

- Hi-end portable devices use stacked integrated circuit (IC) technologies








Package-on-package (PoP)

ORIGINATED MID-2000s
Advantages: Components easier to test before stacking
Disadvantages: Hard to test after stacking
Typical uses: Digital still cameras, high-end smartphones, tablet computers

Fig from [Apte et al. 2011](#)

- Data consumption depends on users' behaviors

Use intensity	Data consumption rate (GB/hr)
Light (Texting, emails, social media)	0.1
Moderate (Streaming 480p video)	1
Heavy (Streaming 4K video)	7

  
 zoom


([Digisuff](#), 2023; [Viana et al](#), 2022)

Challenge #1:

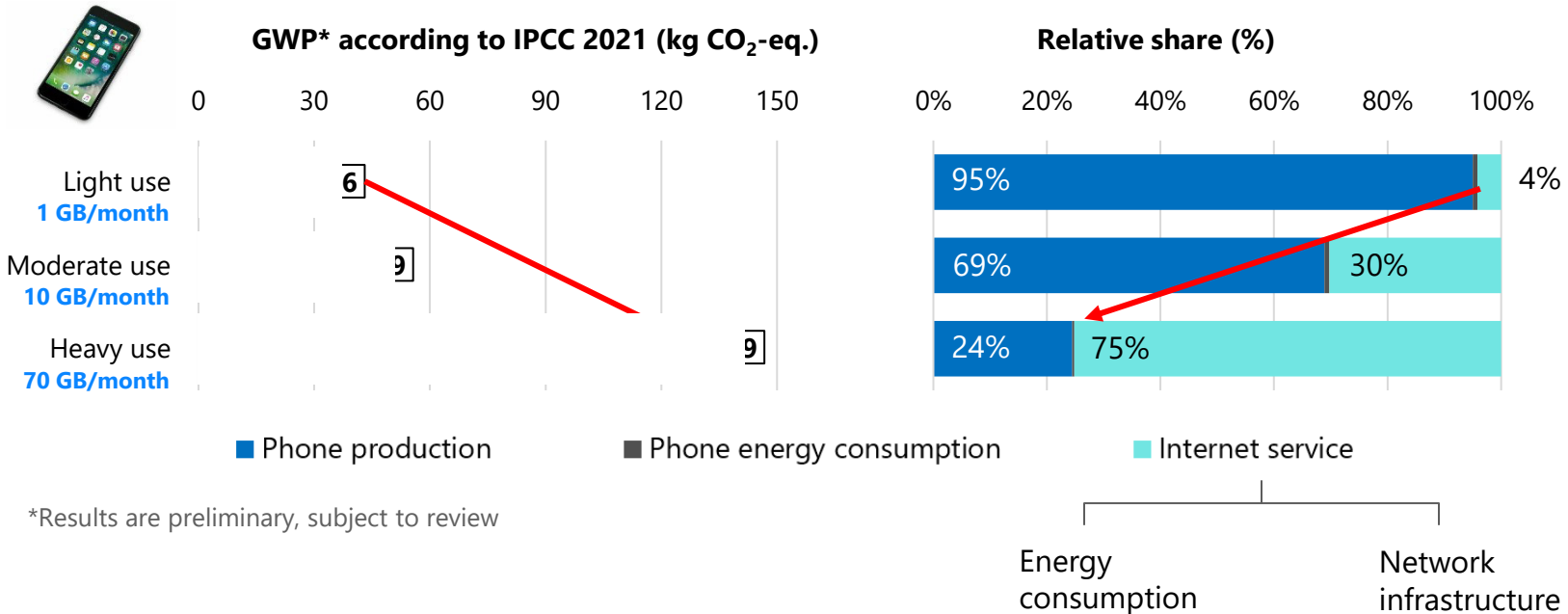
- IC design may vary across brands
- Technical data is barely available

Challenge #2:

- Large differences between users

LCIA of 3 distinct smartphone use scenarios

Functional unit: the use of a smartphone in Switzerland, with 2 years lifetime



Closing: “Are our phones the hotspot of ICT device use”?

The “LCA-style”
answer to that is...

- Towards reducing the environmental impacts of ICT:

Yes

No

It Depends



on the modeling
assumptions in the
parameterized models
for the ICT sector



Semiconductor manufacturers: Provide access to critical ICT parameters, e.g., IC/wafer areas



Users: Encourage people to choose eco-conscious ICT providers, both physical and cloud sides



Telecom operators: Play a key role, especially where data consumption is high

Thank you for listening! 😊

Project collaborators:



For more information and details, please contact us:



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