
Vers une utilisation “sobre” des centres de données

Les sciences sociales à la rescousse de l'informatique

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About me

- [Maël Madon](#), 2nd year PhD student
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- Supervisors:
 - [Georges Da Costa](#)
 - [Jean-Marc Pierson](#)

SEPIA



Context

Global

Global greenhouse gas emissions and warming scenarios

- Each pathway comes with uncertainty, marked by the shading from low to high emissions under each scenario.
- Warming refers to the expected global temperature rise by 2100, relative to pre-industrial temperatures.



Annual global greenhouse gas emissions
in gigatonnes of carbon dioxide-equivalents

150 Gt

100 Gt

50 Gt

0

1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100

No climate policies
4.1 - 4.8 °C

→ expected emissions in a baseline scenario if countries had not implemented climate reduction policies.

Current policies
2.5 - 2.9 °C

→ emissions with current climate policies in place result in warming of 2.5 to 2.9°C by 2100.

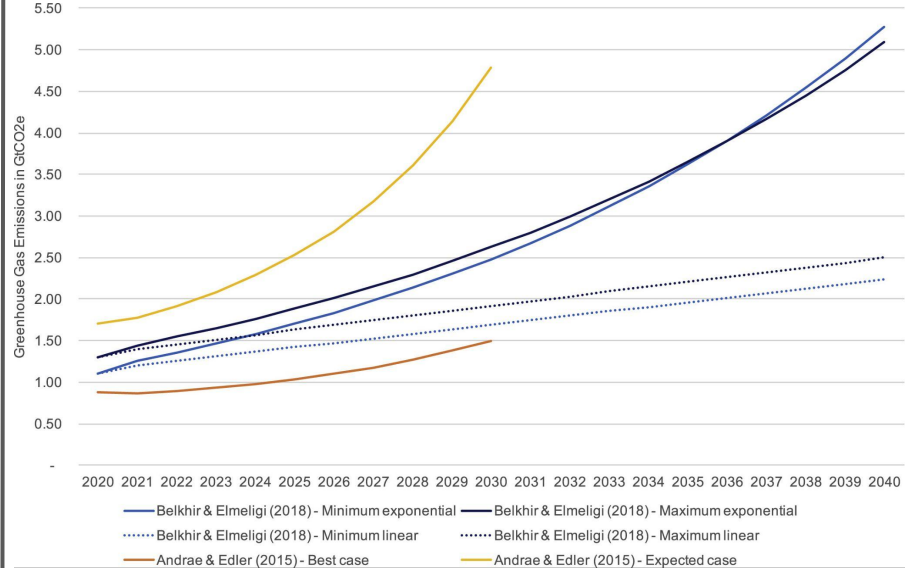
Pledges & targets (2.1 °C)
→ emissions if all countries delivered on reduction pledges result in warming of 2.1°C by 2100.

2°C pathways
1.5°C pathways

Data source: Climate Action Tracker (based on national policies and pledges as of November 2021).
OurWorldinData.org – Research and data to make progress against the world's largest problems.

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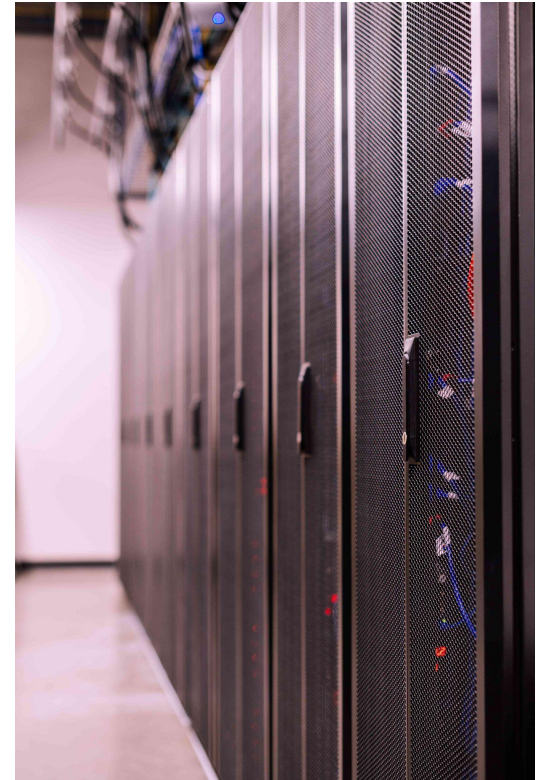
ICT industry



Source: Projections of ICT's GHG emissions from 2020, Freitag et al. 2021

Efficiency in data centers

- **Energy efficiency**
(virtualization, workload consolidation, DVFS...)
- **Use of renewable energies**
(workload adaptation to power envelope, geographic load shifting, ...)
- **Data center environment**
(cooling management, waste heat utilization, use of batteries)



Efficiency techniques

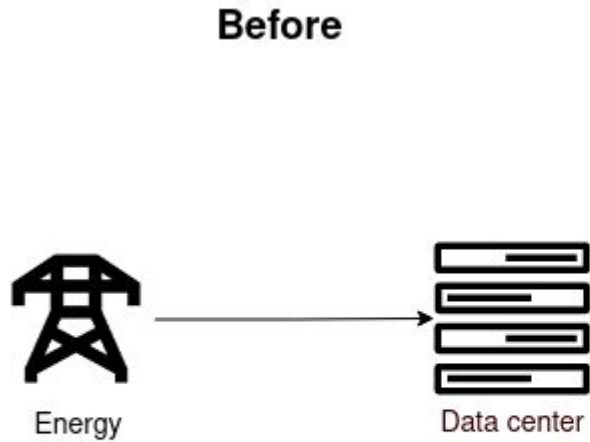
Before



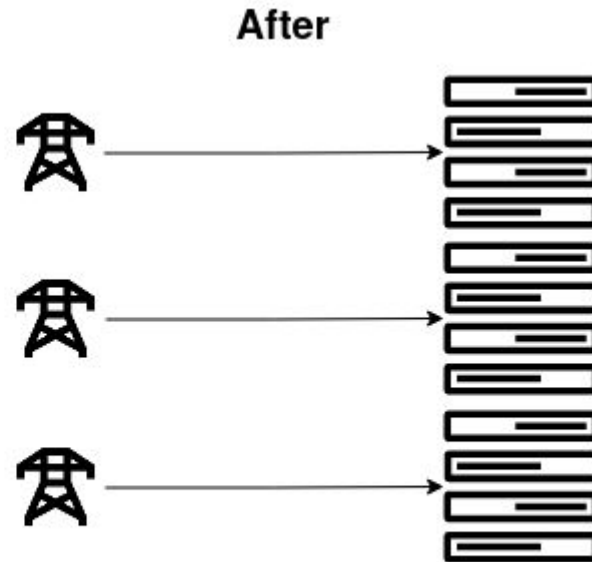
After



Rebound effect?



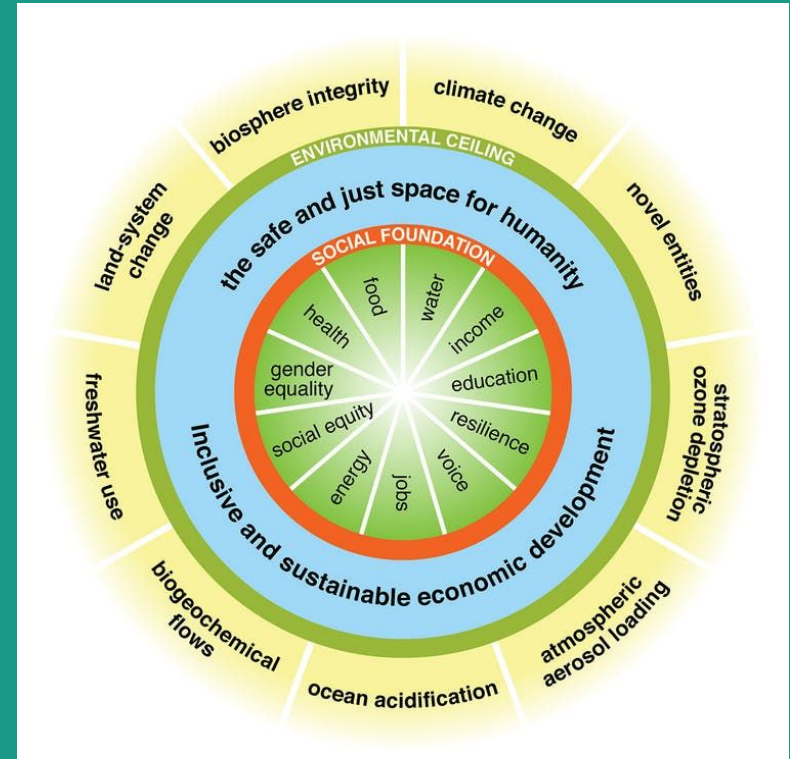
Data center = 1
Energy = 2



Data center = 3
Energy = 3

Sufficiency (fr: “sobriété”)

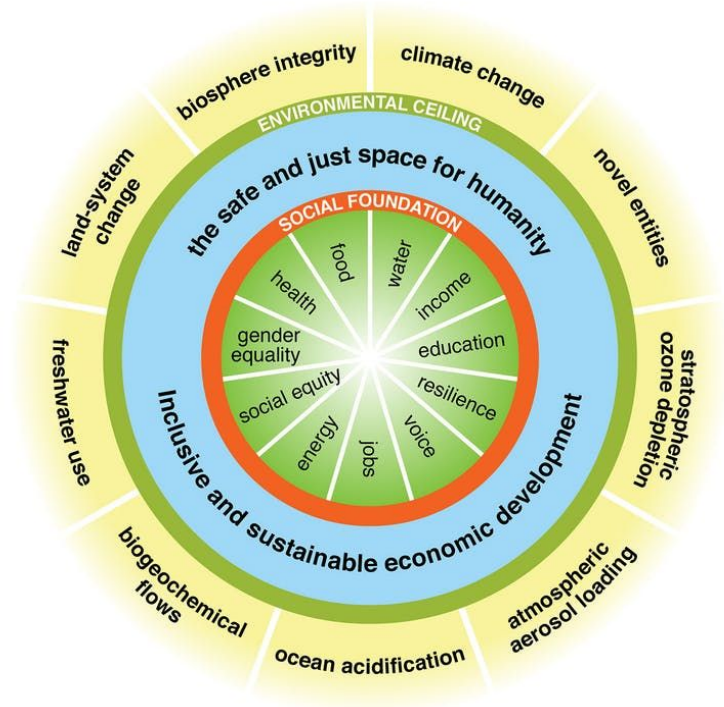
*“A set of measures and daily practices that **avoid demand** for energy, materials, land and water while delivering **human well-being for all within planetary boundaries.**” (IPCC, 2022)*



Kate Raworth's "donut"

Sufficiency in data centers?

- Environmental ceiling → LCA
- Social foundations → social sciences
- Previous works:
 - **simulation** ([EuroPar'22](#)): understand how the user submission behavior affects the load in a data center
 - **qualitative study** (ICT4S'23?): digital sufficiency in flexible work



The study: Digital Sufficiency in Flexible Work

Definitions & goal

- **Digital Sufficiency**¹
any strategy aimed at reducing the *demand* for digital devices or services
- **Case of flexible working**
a way of working that suits an employee's needs, for example having flexible start and finish times, or working from home

How much and which cloud usage is “sufficient” for flexible work?



¹ T. Santarius et al., “Digital sufficiency: conceptual considerations for ICTs on a finite planet”, 2022

Research questions

- What do we do on our computers? Which tasks are cloud-based?
- Among the cloud-based tasks, which ones are perceived as *necessary*, and under which circumstances?
 - identify **tactics toward sufficiency**



Qualitative research method

Data collection

- 3 focus groups
- 2 companies
- 11 participants



Focus group

List the tasks that you do
on your computer/phone
in your working day.

In a specific work setting



For each cloud-based daily task
Could you do without?

- If yes, how?
- If no, why?

Which of them are
cloud-based?



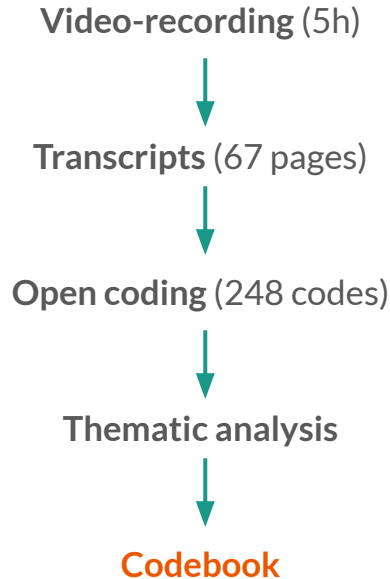
Imagine now:

**“Superfluous” tasks can
be enabled/disabled**

- do you see potential benefits?
- and any challenges?



Data analysis



Focus Group A

Maël Madon 58 days ago · Show only my coding

#1 [What is flexible work for you? (9:54→17:24)]

#2 Mod1: instead of, like, talking about just the phone and our personal use, focus on our work use and try to, like, think about the digital technologies that we use and, like, how it was 10 years ago, why... is that necessary? Superfluous? and stuff. So we will start with a round the table. So, I know that you answered the form already but I just want to know what is flexible work for you, how is your working week organized? ... So whenever someone wants to...

#3 P2(Y): So I'm mostly working from home. I think, 80%, and one day here

 [work_setting / work_location/home](#)
Coding by Maël Madon 58 days ago · Remove

#4 P1(Rm): that's 4 out of 5 days, right?

#5 P2(Y): yeah, that's flexible work for me because I can.. we do have a daily standup and a specific time so you need to be there. But other than that I can do whatever I want: if I want to work, I can work, if I want to do groceries I do that. So that's kind of flexible work for me as a definition.

 [choice_of_location / task_driven/task_locality](#)
Coding by Maël Madon 17 days ago · Remove

 [work_setting / work_hours/flexible](#)
Coding by Maël Madon 58 days ago · Remove

#6 Mod1: any other locations? Home and office, right? P2(Y): yeah, that's it

#7 Mod1: you want to note them down? Two words, left column, "work location" Mod2: yeah

Results



List of digital usages

Categories of cloud-based tasks:

1. interactive (needs constant access)
2. offline with regular synchronization
3. off-cloud

Suggestion towards sufficiency:

Moving from (1) to (2) or from (2) to (3)

Task	#
email	9
messaging	6
planning	5
online meeting	5
phone	4
reviewing	4
project management	4
data analysis	4
preparing presentation	3
giving presentation	3
gathering information (internal)	3
gathering information (external)	3
writing time	2
writing documents	2
watching video	1
taking notes	1
online training	1
online presence	1
creating visuals	1
brainstorming	1
attending digital event	1



Work setting

Reasons to choose a location:

- task driven
- opportunistic driven
- no choice

Suggestion towards sufficiency:

Planning ahead for quality work in the appropriate environment

Choice of tasks driven by location:

- location highly interchangeable
- tasks in the train:
 - individual tasks (email, reading up, ...)
 - no meeting

Suggestion towards sufficiency:

Working from constrained environments allows progressing on individual tasks while reducing digital usage to the essential



Zooming in: online meetings

Necessary	Superfluous
Save travel time To keep human contact Easier to arrange For team work Camera for facial expressions ...	Too many meetings Too long meetings Recurring meetings Duplication of channels ...

Suggestion towards sufficiency:

Understand the **nature** of the service rendered by the task = what should be focused on for sufficient use



Tactics towards sufficiency

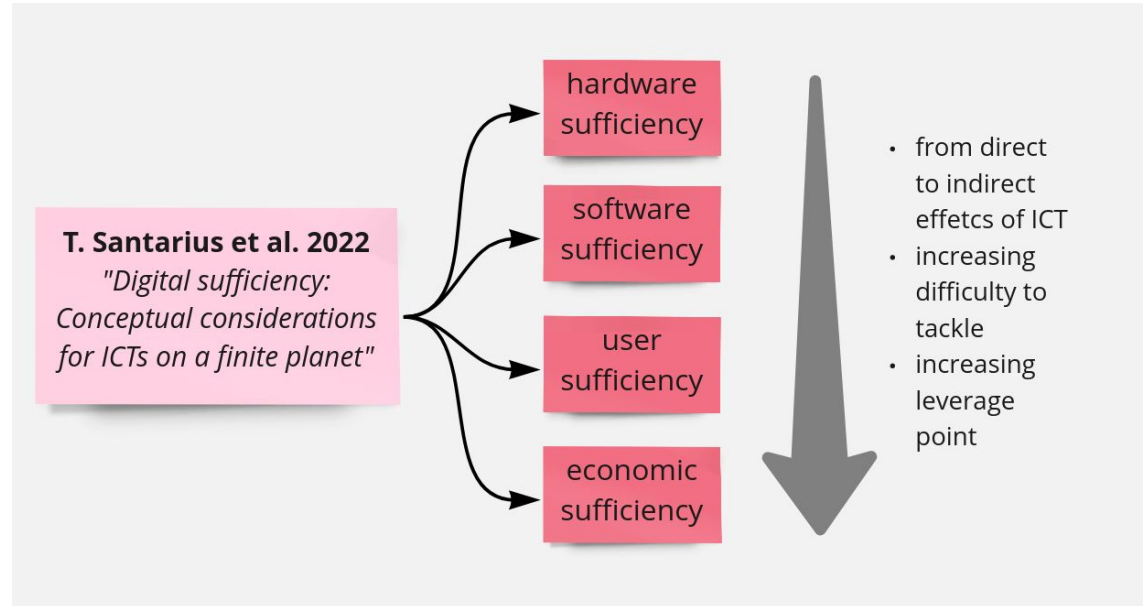
- 48 tactics extracted from the focus group discussions
- Example:

Tactic	Goal	Classification
set mailbox quotas	countering data accumulation	system-oriented
block focus time in agenda	increasing focus	human-oriented
prepare before meeting	rationalizing meetings	human-oriented
give more freedom to employees to use their device	avoid overconsumption	context-oriented

Discussion

Dimensions of digital sufficiency

- Multi-dimensional
- Multi-stakeholder
 - producer/developer
 - seller/provider
 - private user
 - organizational user
 - policy regulator
 - civil society





Credits

- icons: www.flaticon.com and www.vecteezy.com
- images: www.pexels.com