Sustainable Digitalization: Why we need to shift away from Big Tech business models

ICT4S, Rennes

June 6, 2023

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Recent work

October 2018

Why we need to implement a sobriety principle in the digital ecosystem to contain its carbon footprint
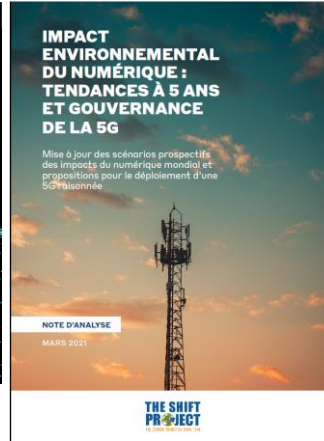
July 2019

Video streaming: an analysis of the drivers leading to unsustainability

October 2020

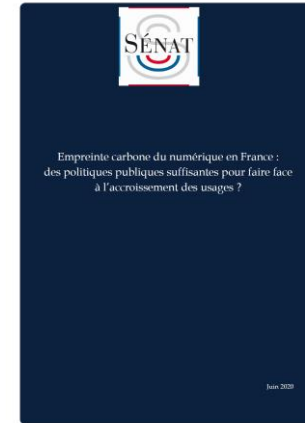How to implement the sobriety principle ? Methodological frameworks

March 2021

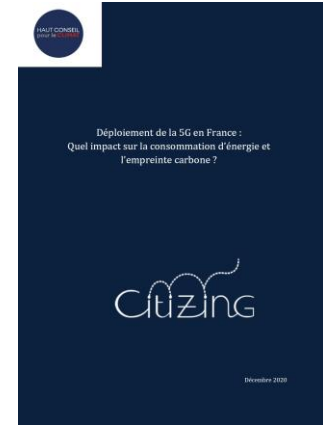2025 outlook and 5G governance framework

October 2020

Digital sobriety: a responsible corporate approach

June 2020

Digital environmental footprint in France and public policies

December 2020

5G impact on digital environmental footprint in France

Corporate digital sustainability strategies

Digital industry players
Insurance, Luxury
Public organizations

— Digitalization for Sustainability —
- Science in Dialogue

A European Research Network for
Deep Sustainability Transitions

ECDF WORKING PAPER SERIES

#005
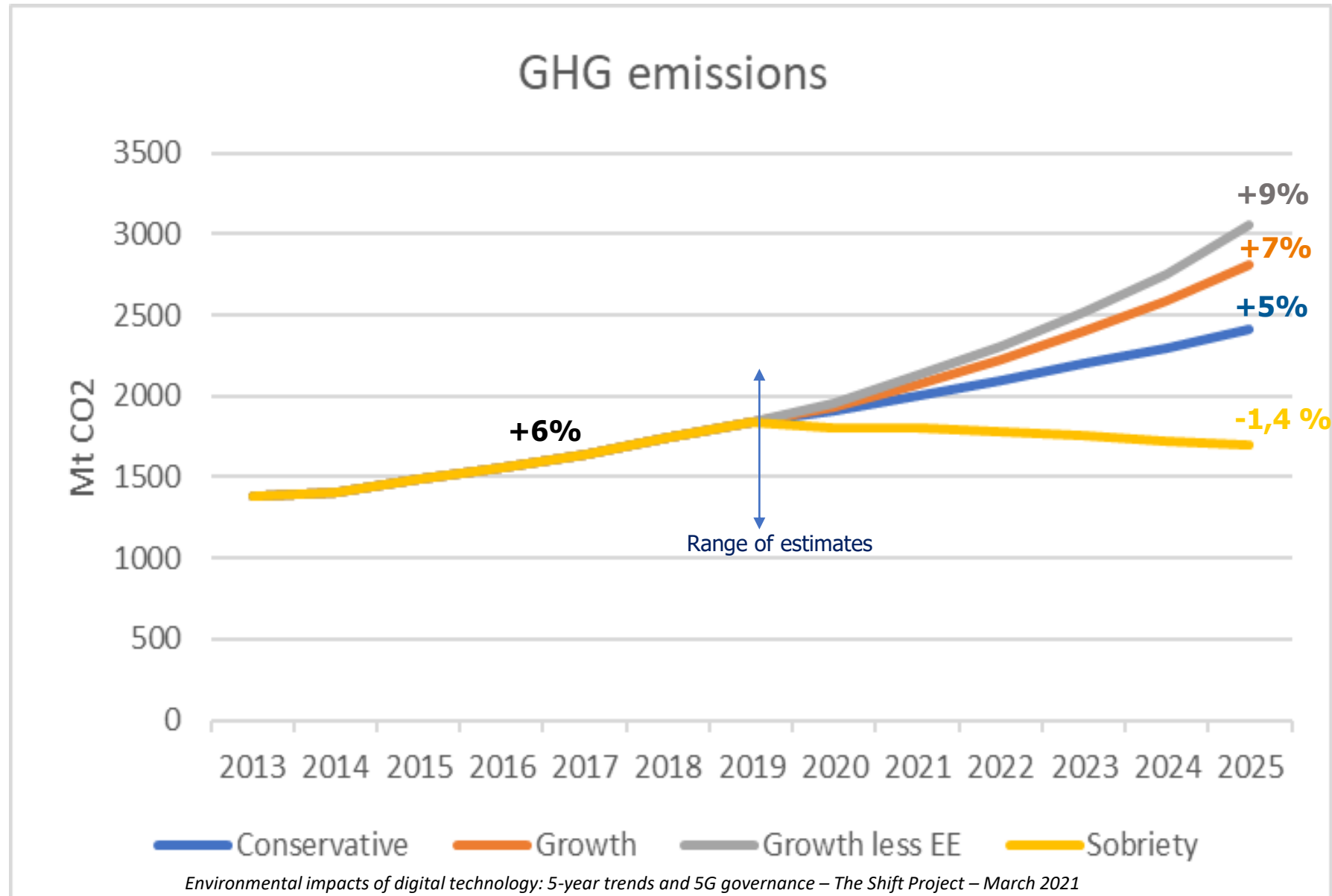Transitioning towards sustainable digital business models

Presentation

➢ The context

➢ Efficiency and affluence

➢ The Big Tech business models: drivers of unsustainability

➢ The way forward

https://digitalization-for-sustainability.com/publications/
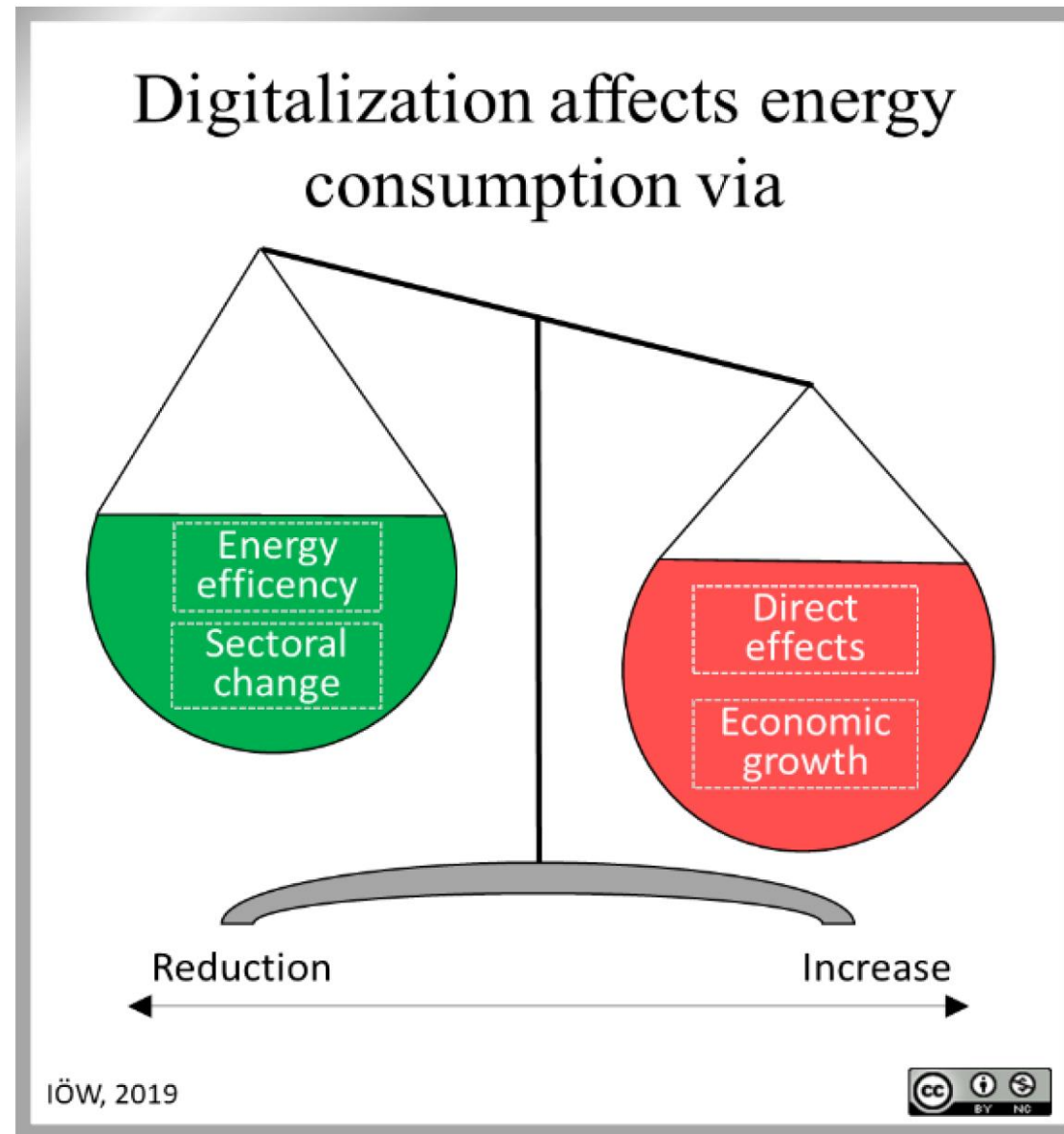
The context

Digitalization is currently unsustainable

The growth is sustained and will continue except if there is a shift **towards digital sobriety/sufficiency**

Current trend would eat up 15% of global GHG reduction by 2030

GHG emissions

Mt CO2 (y-axis): 0, 500, 1000, 1500, 2000, 2500, 3000, 3500

Years (x-axis): 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

+6%

+9%
+7%
+5%
-1,4 %

Range of estimates

— Conservative — Growth — Growth less EE — Sobriety

Environmental impacts of digital technology: 5-year trends and 5G governance – The Shift Project – March 2021

Digitalization has not resulted in decoupling growth and energy

Digitalization affects energy consumption via

Energy efficiency
Sectoral change

Direct effects
Economic growth

Reduction ←→ Increase

IÖW, 2019

Lange, S., Pohl, J., & Santarius, T. (2020). Digitalization and energy consumption. Does ICT reduce energy demand?

Digital Reset

A fundamental redirection of the purpose of digital technologies for the deep sustainability transformation

Digitalization for Sustainability (D4S), 2022: Digital Reset. Redirecting Technologies for the Deep Sustainability Transformation. Berlin: TU Berlin
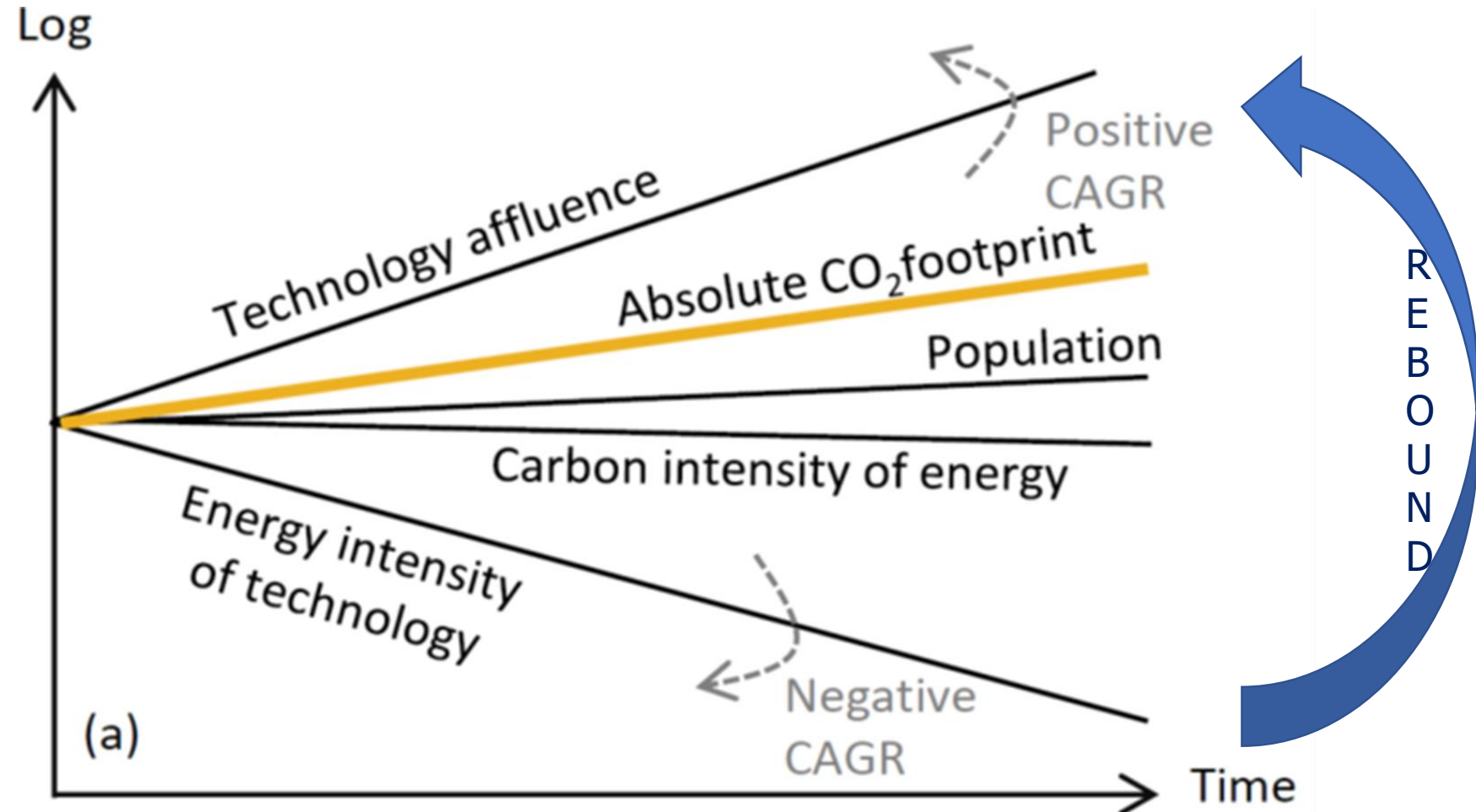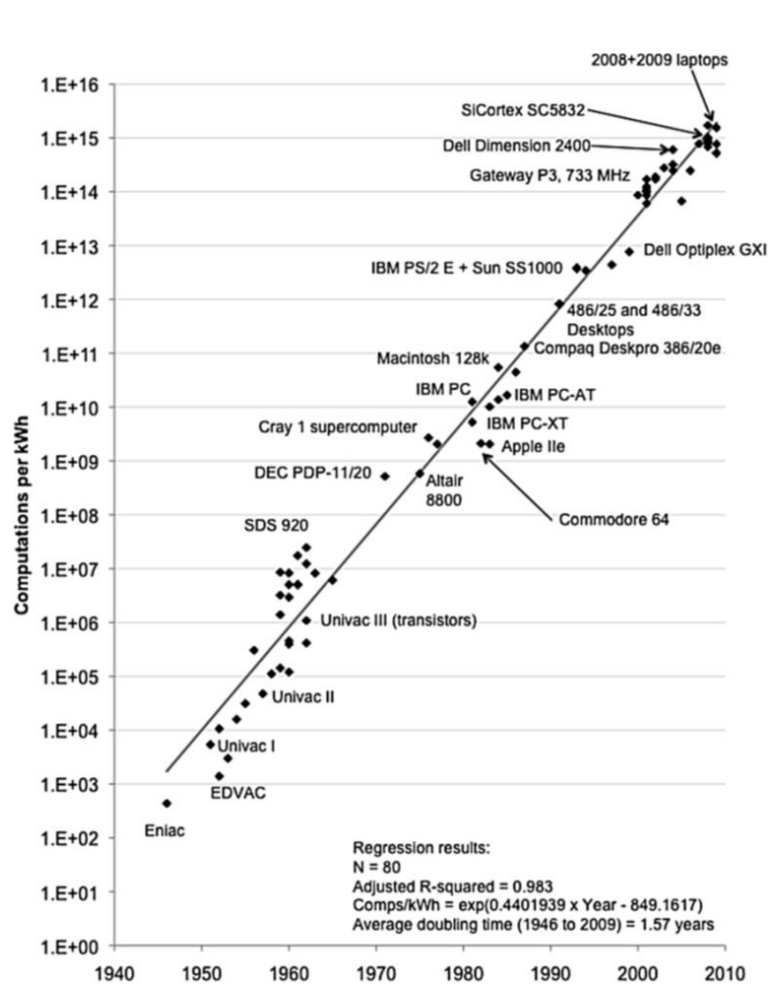
The ICT sector needs to transform deeply

Seven Principles for a Digital Reset

- Regenerative Design
- System Innovations
- Sufficiency
- Circularity
- Sovereignty
- Resilience
- Equity

Digitalization for Sustainability (D4S), 2022: Digital Reset. Redirecting Technologies for the Deep Sustainability Transformation. Berlin: TU Berlin

Efficiency and affluence

Technology affluence grows more than energy efficiency

Digital CO2 footprint = Population × Digital Technology Affluence × Energy Intensity of Technology × Carbon Intensity

Moore's Law and ICT Innovation in the Anthropocene (2021)
David Bol, Thibault Pirson and Remi Dekimpe

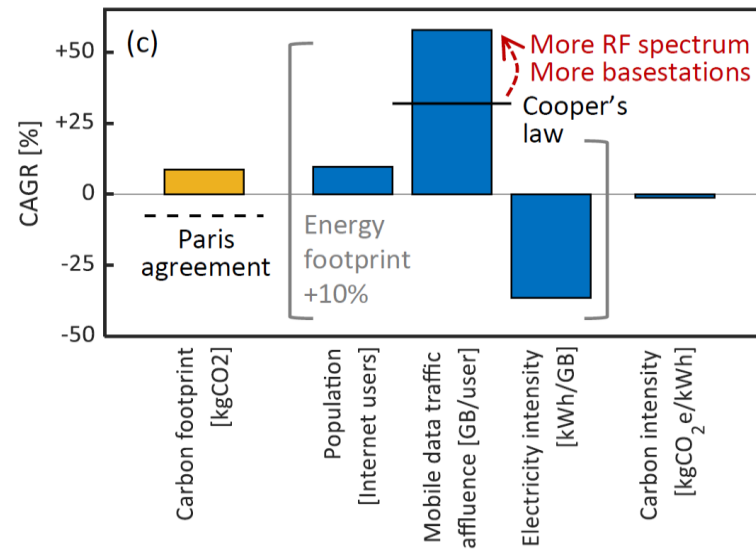# Technology affluence grows more than energy efficiency

End user devices

Networks

Data centers

$$CO_2e = Users \times \frac{Transistors}{User} \times \frac{Wafers}{Transistor} \times \frac{kWh}{Wafer} \times \frac{CO_2e}{kWh}$$
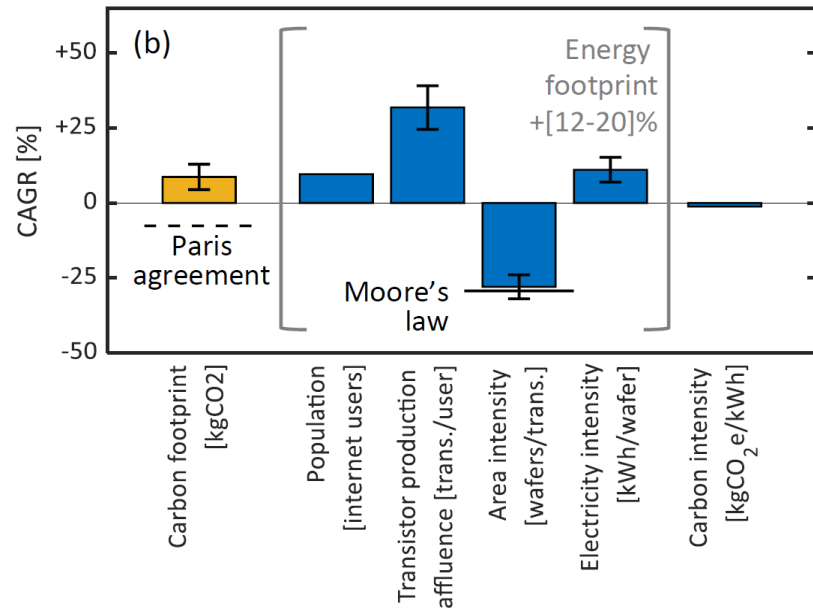
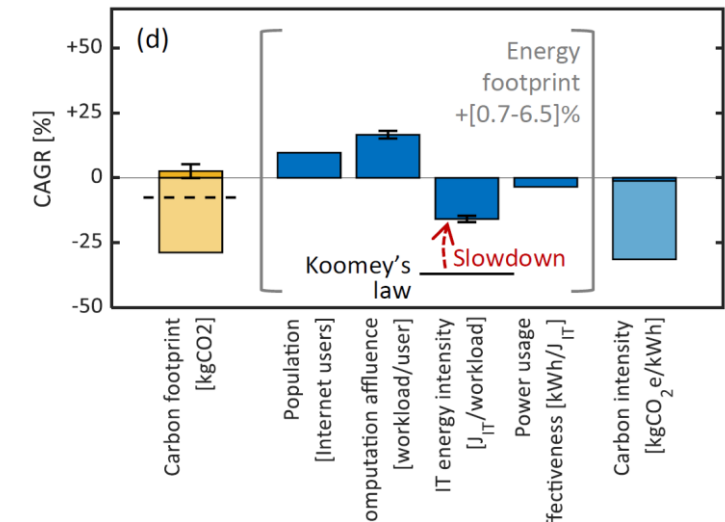$$CO_2e = Users \times \frac{GB}{User} \times \frac{kWh}{GB} \times \frac{CO_2e}{kWh}$$

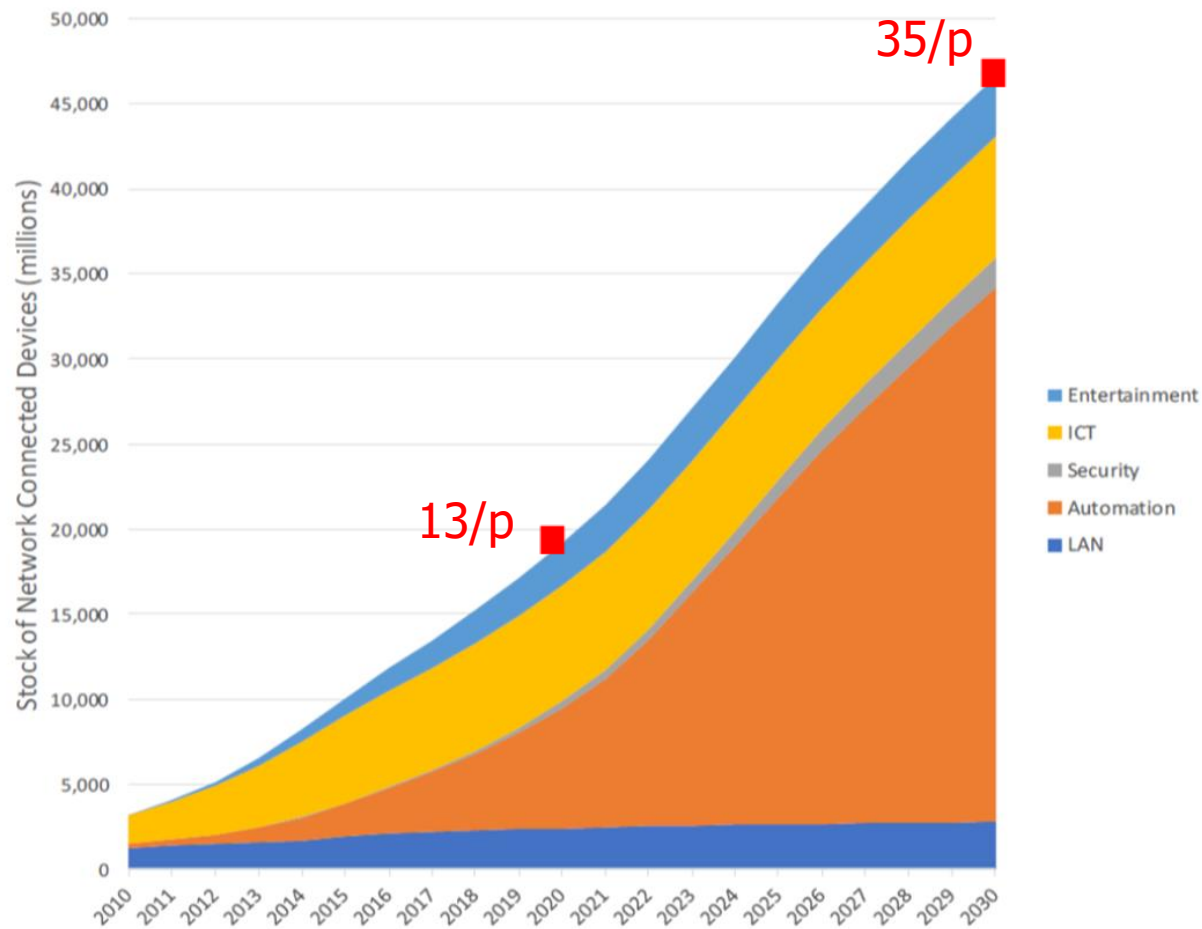$$CO_2e = Users \times \frac{Workload}{User} \times \frac{J_{IT}}{Workload} \times \frac{kWh}{J_{IT}} \times \frac{CO_2e}{kWh}$$

Digital affluence (excessive growth of) is the issue

Digital CO_2 footprint = Population × Digital Technology Affluence × Energy Intensity of Technology × Carbon Intensity
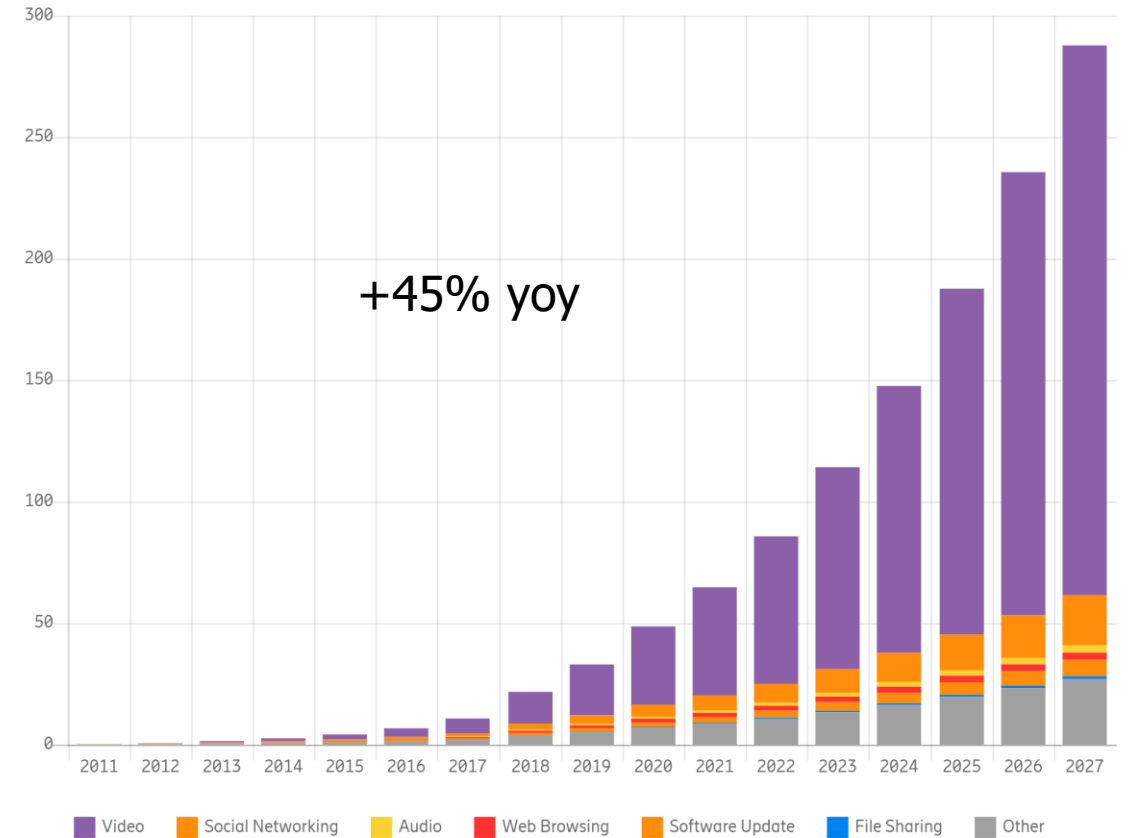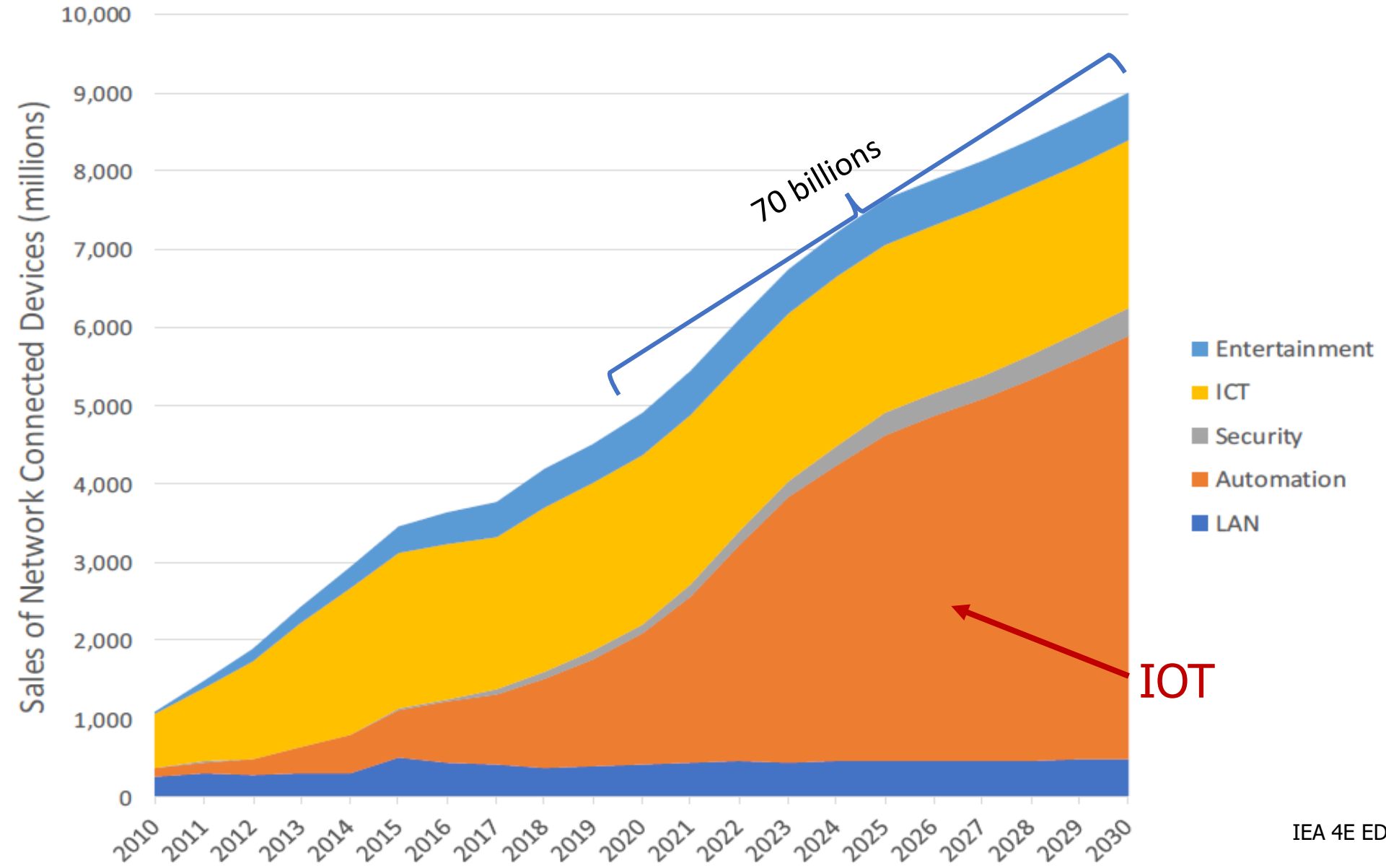

IEA 4E EDNA, 2019

Digital affluence (excessive growth of) is the issue

IEA 4E EDNA, 2019

Digital affluence hypergrowth: a systemic issue

We face a system design issue
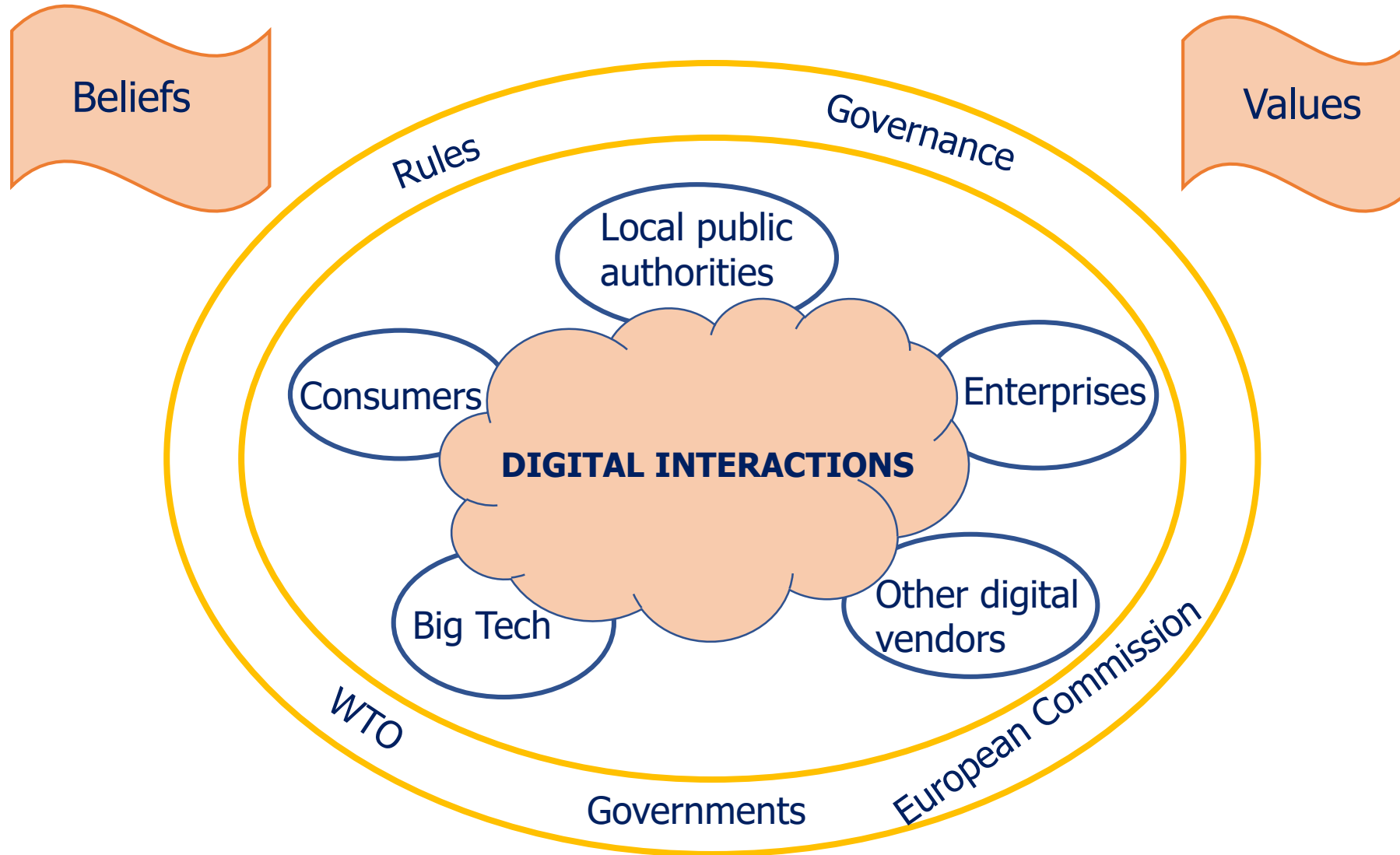
We face a system design issue

Digital technology affluence is growing due to societal and economic behaviours:

- Digital consumers unaware of the impacts (environment, health, behavior etc) and digitally hungry

- Enterprises engaged in digital transitions without connecting them to increasingly stringent environmental/energy transitions (eg IOT)

- Public authorities encouraging indiscriminate "digital transition projects » bound to yield economic growth

- Software-induced obsolescence boosting hardware production in line with linear business models

- Big Tech (GAFAM, BATX) relying on audience maximization (two-sided market business model) and using addictive design techniques

The Big Tech business models: drivers of unsustainability

Market dominance

The Big Tech are financial superpowers

Company	Market capitalization (B$, 2020)	Rank
APPLE	2300	1
MICROSOFT	1700	3
AMAZON	1600	4
ALPHABET/GOOGLE	950	5
FACEBOOK	800	6
TENCENT	700	7
ALIBABA	650	9
NETFLIX	240	33
TOTAL	~ 9000	

The Big Tech overpower the ICT sector

Digital ecosystem revenue[1]
World, 2011-2020, billion euros[2]

Category	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	2 737	2 943	3 020	3 118	3 356	3 555	3 861	4 294	4 562	4 849
Internet	117	146	177	220	270	351	464	599	730	931
Content	164	158	153	159	167	189	212	235	261	263
IT / Software	395	416	425	452	462	474	488	546	589	621
Devices[3]	1 003	1 166	1 184	1 175	1 291	1 276	1 402	1 544	1 564	1 602
Network Equipment	143	124	124	128	138	154	158	163	177	178
Telecom Operator[3]	915	933	957	983	1 027	1 109	1 136	1 206	1 241	1 254

Annual growth

	2011-20	2019-20
	+6.6%	+6.3%
Internet	+26%	+27%
Content	+5%	+1%
IT / Software	+5%	+5%
Devices	+5%	+2%
Network Equipment	+2%	+1%
Telecom Operator	+4%	+1%

Example of players

Google, Alibaba Group, Facebook, amazon, JD.COM

vivendi, VIACOMCBS, The Walt Disney Company, NETFLIX, Nintendo, BERTELSMANN

IBM, ORACLE, FUJITSU, Microsoft, TATA, accenture, Capgemini

SAMSUNG, DELL, HUAWEI, foxconn, Apple

ERICSSON, ZTE, CISCO, NOKIA

COMCAST, AT&T, 中国移动 China Mobile, Deutsche Telekom, verizon

The Big Tech create the market dynamics

2021

Application Group	Total Volume
1 Google	20.99%
2 Facebook	15.39%
3 Netflix	9.39%
4 Apple	4.18%
5 Amazon	3.68%
6 Microsoft	3.32%
TOTAL	56.96%

Sandvine Global Internet Report, 2021

Global Smart Speaker Market Share By Vendor

Smart Speaker Market Share by Vendor

■ Q4 2018   ■ Q4 2019

Amazon: 28.30%
Google: 24.90%
Baidu: 10.60%
Alibaba: 9.80%
Xiaomi: 8.40%
Apple: 4.70%
Others: 13.30%

Source: Speakergy.com & Strategic Analytics
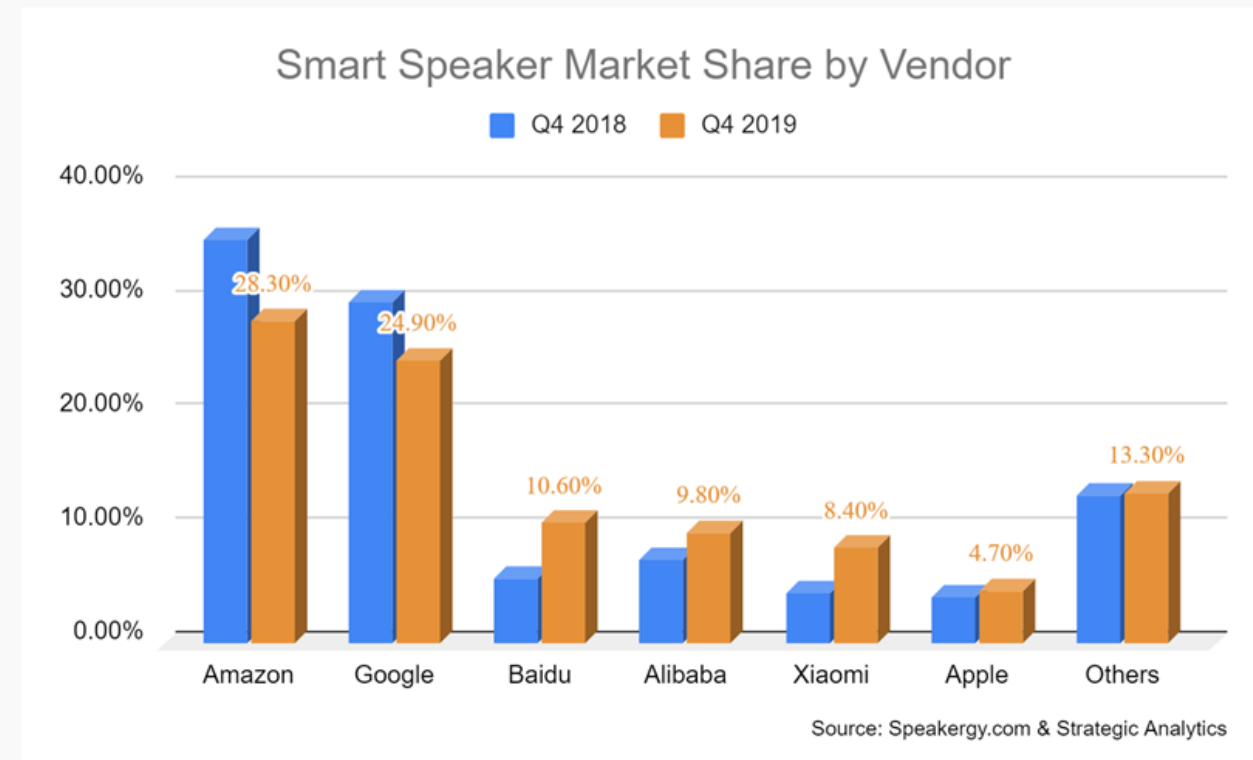
75% of total Internet traffic growth

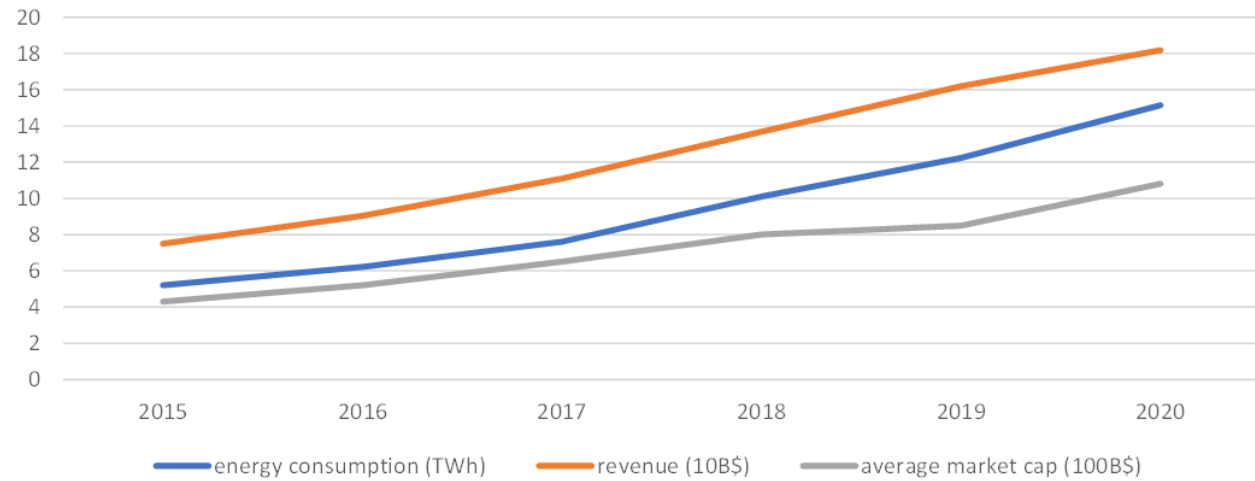# Digital affluence as a production factor

Digital affluence fueling financial value

- Big Tech are Multi Sided platforms

- Audience monetization as major source of revenue

- Value capture $= f(\#\ users, user\ engagement)$

- Addictive design and data intensive content to attract, stimulate and retain users
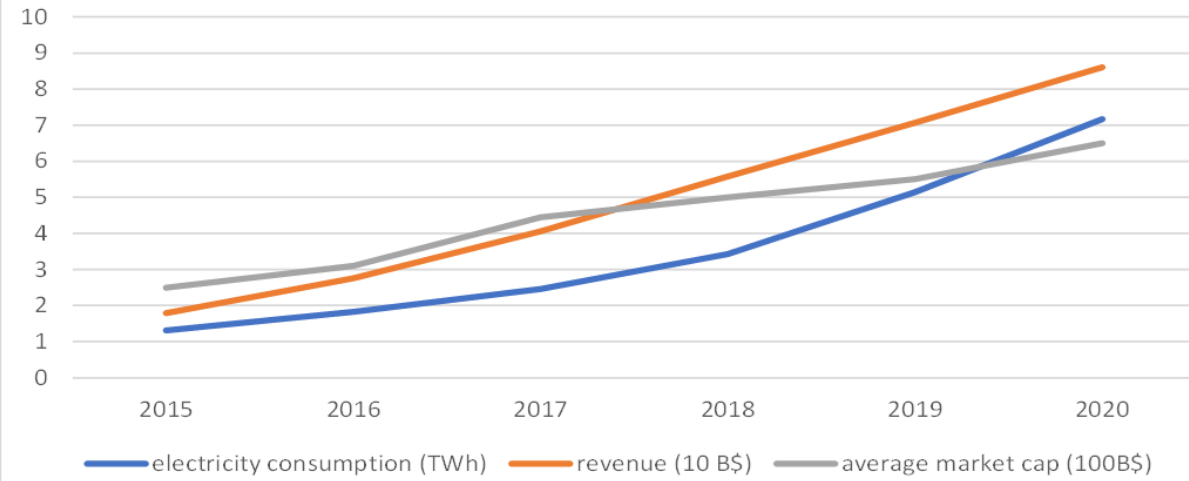
- Digital affluence as a (free) production factor

URI: http://hdl.handle.net/10125/41374
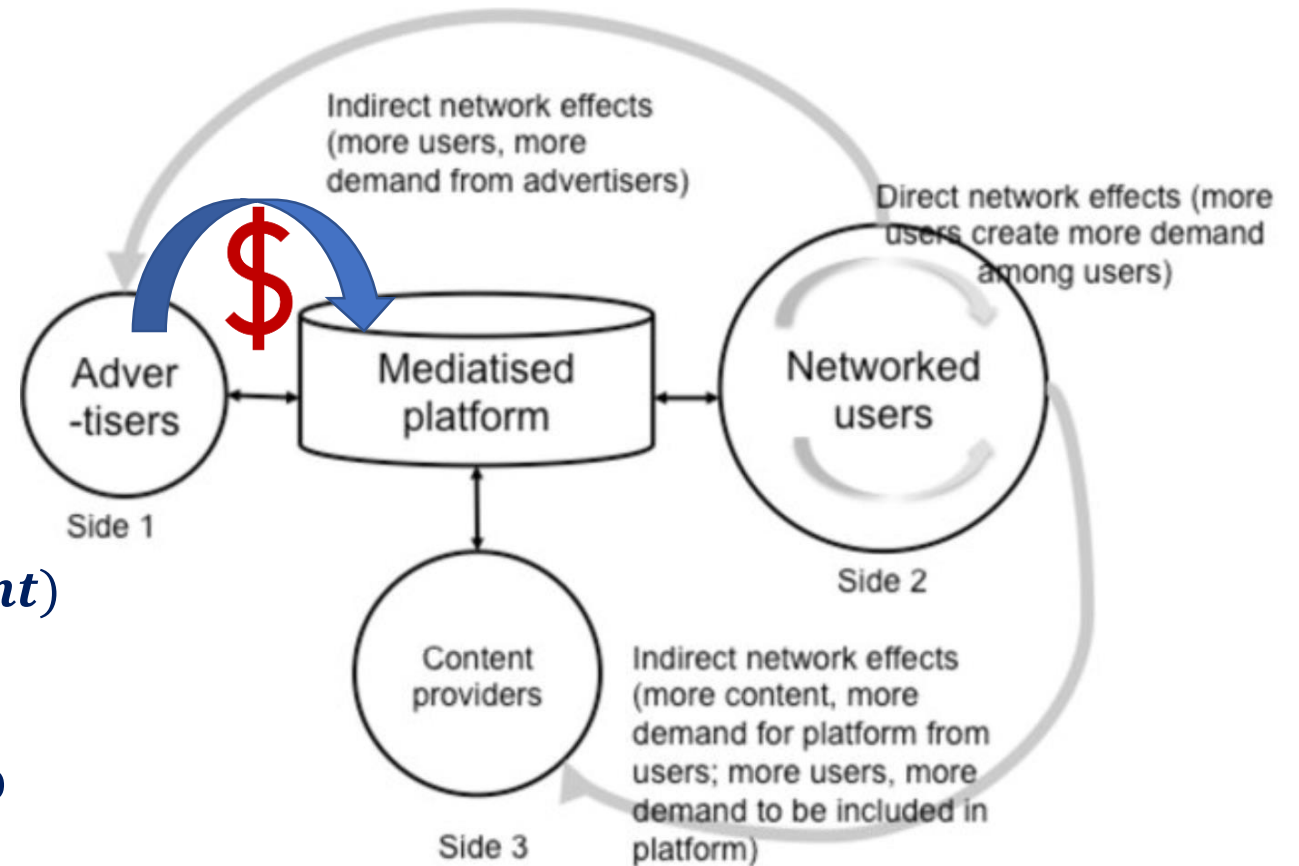
The Big Tech business models: energy intensive, data hungry

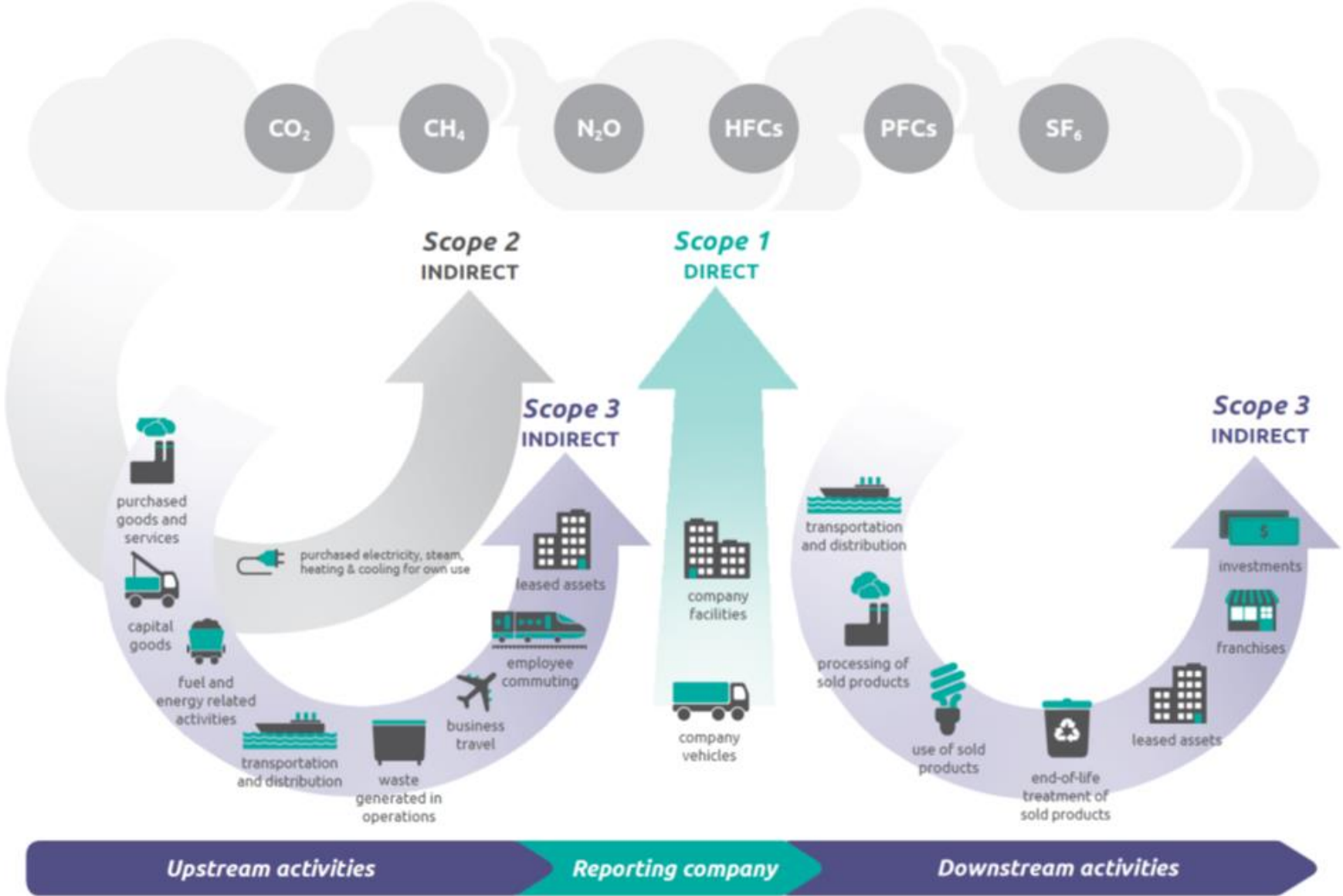Google: revenue, energy consumption, market cap
- energy consumption (TWh)
- revenue (10B$)
- average market cap (100B$)

Meta: revenue, energy consumption, market cap
- electricity consumption (TWh)
- revenue (10 B$)
- average market cap (100B$)

CAGR 2015-2020	Google	Meta
Revenue	20,0%	37,0%
Energy consumption	24,0%	40,0%
Market capitalization	20,0%	21,0%
Revenue energy intensity	3,8%	2,7%
Internet traffic	42,0%	60,0%

(CAGR Internet traffic 2015-2020 = 29%)

Misleading carbon neutral strategies

Sustainability across the value chain

"Carbon –neutral" strategies: all Big Tech will power all their sites (data centers) with renewable energy by 2030

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Carbon neutrality in 2050 needs GHG emissions to be reduced by half in 2030 (source: IPCC 2022)

Carbon intensity of electricity: 2019 = 0,6 kgCO2/kWh   2030 Big Tech = 0,06   2030 value chain = 0,3

	2019	CAGR 2019/2025	2030
Hyperscale data centers: electricity consumption (TWh)	70	15.8%	349
Networks: electricity consumption (TWh)	349	5.0%	598
End-user devices electricity consumption (TWh)	505	7.5%	1120
Hyperscale data centers: share of total data center workload	0.48	4.0%	0.81

Source: The Shift Project, 2021

GHG(data centers, networks, devices) = ELEC(data centers, networks, devices) * (carbon intensity of electricity)

The Big Tech's value chain cannot be sustainable (1)

$ELEC_{2019}(\text{Big Tech})= 70 \text{ TWh}$ ⟶ **+400%** ⟶ $ELEC_{2030}(\text{Big Tech})=349 \text{ TWh}$

$GHG2019(\text{BigTech})=42 \text{ MtCO2}$ ⟶ **-50%** ⟶ $GHG2030(\text{BigTech}) = 21 \text{ MtCO2}$

**« Greening » 100% of their electricity consumption
DOES reduce by half Big Tech's scope 2 emissions**

+260%

$ELEC_{2019}$(value chain) = 480 TWh $\longrightarrow$ $ELEC_{2030}$(value chain) = 1.740 TWh

+50%

GHG_{2019}(value chain) = 288 MtCO2 $\longrightarrow$ GHG_{2030}(value chain) = 438 MtCO2

Big Tech "carbon –neutral" strategies will actually drive up by 50% the carbon footprint of their <u>value chain</u>

Indirectly they perpetuate the myth of decoupling digital hypergrowth and carbon emissions

The way forward

Where to: alternative platform business models

Moving **away** from business models where revenue is generated by the sale of user-related information in exchange to free access to platform services and where the capture of user-related data is optimized thanks to addictive design techniques and digitally rich targeted advertising

Examples

➤ Subscription-based services (eg mail, search, etc..)

➤ Cooperative platforms: voluntary provision of <u>specific</u> personal data, buyer/seller community
  ➤ Platformization of existing cooperatives
  ➤ Start-ups

➤ Public platforms

How: public policies forcing changes

- **Make Big Tech smaller**: taxes, regulations, anti-trust measures etc…

- Make Big Tech business models less financially attractive: reinternalize externalities (eg network costs)

- Enforce scope 3 (value chain) carbon footprint measurement

- Forbid the acquisition of personal data by default (# current terms of reference)

- Support and adopt new web standards (web 3 ?) giving individual users full control over the usage of their data

- Support (including financially) alternative platforms

Questions ?

https://digitalization-for-sustainability.com/publications/