



"LEAN ICT" --- TOWARDS DIGITAL SOBRIETY

Executive summary

Of the report from the "Lean ICT" taskforce led by Hugues Ferreboeuf

CONTEXT

The Paris Agreement commits all countries to end fossil fuel dependency as quickly as possible. Fossil fuels represent 80% of worldwide energy consumption and are the main sources of anthropic greenhouse gas emissions. Any increase in global energy consumption hinders the success of this historical and vital challenge: preventing climate chaos.

Digital technologies are essential for economic and social development. **The digital transition appears to be critical** for countries and companies with digital objects and interfaces gradually becoming part of every aspect of our social life. The digital transition is also considered to be a key tool to reduce energy consumption in many sectors ("IT for Green"), to such an extent that it now hardly seems possible to address climate change without the large scale incorporation of digital technologies.

However, direct and indirect **environmental impacts (rebound effects) related to the growing use of digital are constantly underestimated**, due to devices' miniaturization and the "invisibility" of the related infrastructures. There is a real risk of a scenario in which increasingly massive investments in digital technologies would contribute to a net increase of digitalized sectors' carbon footprint- which has in practice been the case for more than a decade.



KEY TAKEAWAYS

The worldwide systemic effects of the current digital transition are for now highly uncertain, whereas they are often considered as positive ex-ante. With appropriate regulation, digital transition can help to reduce energy and raw materials consumption on a sectoral basis. Furthermore, the energy efficiency of digital technologies has already significantly improved. However, the major global trends of all sectors combined paint an alarming picture. Damaging environmental impacts caused by the explosion of digital technologies can and should be avoided by implementing what we call "digital sobriety".

THE DIGITAL OVERCONSUMPTION TREND IS NOT SUSTAINABLE IN REGARD TO ITS NEED FOR ENERGY AND RAW MATERIALS

The digital transition currently generates a strong increase in the direct energy footprint of ICT. This footprint includes the energy for the production and the use of equipment (servers, networks, terminals) which is increasing rapidly, by 9% per year.

- **The capture of a gradually disproportionate part of available electricity** increases the demand on electric production, which already struggles to decarbonize.
- **The share of digital technologies in global greenhouse gas emissions has increased by half since 2013**, from 2.5% to 3.7% of global emissions. The demand for raw materials such as rare and critical metals, essential for both digital and low-carbon energy technologies, is also growing.
- **The explosion of video uses** (Skype, streaming, etc.) and the increased consumption of short-lifespan digital equipment are the main drivers of this inflation.

THE DIGITAL INDUSTRY'S ENERGY INTENSITY IS INCREASING GLOBALLY

This increase, 4% per year, is in stark contrast to the trend of global GDP's energy intensity evolution, which is currently declining by 1.8% per year.

- **The direct energy consumption caused by \$1 invested in digital technologies has increased by 37%** compared to 2010.
- **This evolution goes against the objective set in the Paris Agreement to decouple** both energy consumption and climate change from GDP growth. Therefore, the real trend of digital is in opposition to its presupposed function of dematerializing the economy.
- **The CO₂ emissions of digital technologies increased by about 450 million tons** since 2013 in OECD countries, while globally, overall CO₂ emissions decreased by 250 million tons of CO₂ over the same period.
- **The net contribution of digital technologies to reducing negative environmental impact is yet to be determined**, sector by sector, by being aware of the numerous possible rebound effects.

CURRENT DIGITAL CONSUMPTION IS HIGHLY POLARIZED

Digital consumption profiles are extremely contrasted. In 2018, an average American owns 10 digitally connected devices and consumes 140 Gigabytes of data monthly while an average Indian only owns one device and consumes 2 Gigabytes monthly.

- **The digital overconsumption is not a global phenomenon: it is caused by high income countries**, for which the major challenge is to take back control of their digital uses.
- **Expected impacts of the digital transition on growth and productivity remain invisible** in developed countries over the last 5 years. OECD's growth rate remains stable around 2% while the annual growth of digital expenditures has increased from 3% to 5%.
- **The key challenge is to plan and prioritize investments** by ensuring they efficiently serve sectoral energy efficiency priorities, as well as recognizing that developing countries will derive the greatest benefits from increasing use of digital technologies.

THE ENVIRONMENTAL IMPACT OF DIGITAL TRANSITION BECOMES MANAGEABLE IF IT IS MORE SOBER

To move from intemperance to sobriety in our relationship with digital technologies would limit digital's energy consumption increase to 1.5%. While this is in line with the global trend for all sectors combined it is not compatible with the Paris Agreement's objectives.

- **Our "Sobriety" scenario is possible without challenging the core principles of the digital transition.** In this scenario, the volume of data flowing through data centers and mobile networks would increase respectively by 17% and 24% per year, and both smartphones and televisions yearly productions stabilize around 2017- whereas their markets in developed countries are close to reaching saturation.
- **Our "Sobriety" scenario is not sufficient to reduce digital environmental footprint.** It only prevents its explosion. Its reduction will need additional efforts.

GLOBAL ANALYSIS



The Shift Project gathered a panel of experts to assess the environmental impact of digital technologies, in the context of digitalization, and therefore the rapid increase of both data flows and installed base of terminals as well as the multiplication of digital uses.

- Experts focused on the **consequences of climate change, on energy consumption** (production, utilization) and on the raw material supply (physical and geopolitical constraints, etc.).
- The definition adopted for "digital" is broad, coherent with the one retained by key sector stakeholders in their forward-looking perspectives. This definition includes **telecommunication networks** (access and transport, stationary, wifi and mobiles);

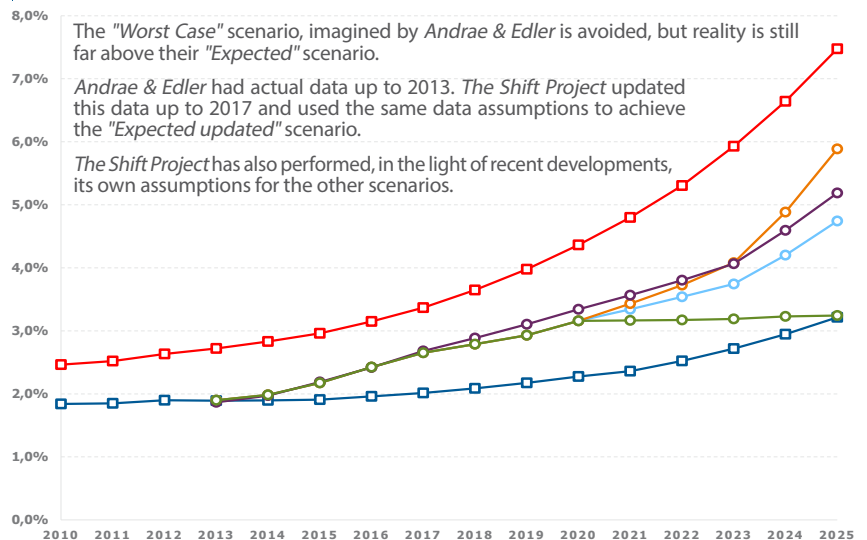
data centers; terminals (stationary and portables personal computers, tablets, smartphones, traditional mobile phones, "boxes", connected audiovisual devices including televisions; **IoT sensors** (Internet of Things). This scope excludes non-communicating digital devices integrated into cars as well as numerical components of industrial production supply chain.

Project director, Hugues Ferreboeuf, gathered **academics, professionals and sector experts**: Françoise Berthoud (CNRS, GDS EcoInfo), Philippe Bihoux (metal experts), Pierre Fabre (AFD), Daniel Kaplan (FING), Laurent Lefèvre (INRIA), Alexandre Monnin (INRIA, ESC-Clermont Origiens Media-Lab), Olivier Ridoux (IRISA, Université de Rennes), Samuli Vajja (ACV expert), Marc Vautier (eco-conception expert), Xavier Verne (major IT projects experts), Alain Ducass (energy and digital in Africa expert), Maxime Efoui-Hess (TSP), Zeynep Kahrman (TSP).

- The task force has met on a regular basis since April 2017 and undertook both **modeling and consolidation of studies** to assess the environmental impacts of digital technologies. The team took into account nearly 170 studies, mostly published between 2014 and 2018.
- The conclusions of the work add weight and urgency to the call to "*decrease environmental impacts of digital technologies and put its innovation potential to the service of ecological transition*" which was initiated by Iddri, the FING, WWF France and Green IT.fr in the "**White Paper Digital and Environment**" in spring 2018. It also asserts the importance of the problem outlined in September 2018 by the report of the United Nations Conference on Trade and Development, which titled "*developing countries may have much to lose in the face of digital monopolies*".

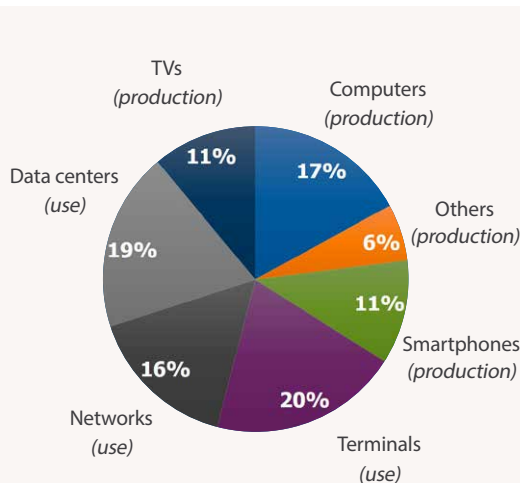
SCENARIOS FOR 2025

- [Andrae&Edler-2015] EXPECTED
- [Andrae&Edler-2015] WORST CASE
- [TSP-2018] HIGHER GROWTH HIGHER ENERGY EFFICIENCY
- [TSP-2018] SUPERIOR GROWTH PEAKED ENERGY EFFICIENCY
- [TSP-2018] SOBRIETY



Evolution of global energy consumption of digital between 2010 and 2025, as a proportion of total world energy consumption

[Source: The Shift Project 2018, as of Andrae & Edler 2015]



Distribution of energy consumption per source for the production and use of digital devices in 2017.

[Source: The Shift Project 2018, as of Andrae & Edler 2015]

MANAGEMENT TOOLS



The Shift Project elaborated several tools to help this paradigm shift.

Intended for large organizations (public administrations, banks, large service companies), these tools should be coupled with public policies pursuing the same objectives.

- **A DIGITAL ENVIRONMENTAL REPOSITORY (DER)** that gives, in an accessible way, verified accounts of the magnitude of energy and raw materials required for the production and use of common digital technologies.
- **LEVERS FOR THE MANAGEMENT** of large organizations: those levers are actions enabling them to act on both demand and consumption of digital services, without hindering their digital transition.
- **PRINCIPLES FOR PUBLIC POLICIES**, notably intended for developing countries, to help them reap the benefits expected from the digital transition.

DIGITAL SOBRIETY: HOW CAN WE DEPLOY IT?



A sober digital transition mainly consists in buying the least powerful equipment possible, in changing them the least often possible, and in reducing unnecessary energy-intensive uses.

Digital sobriety is a "lean" approach, which is also a source of efficiency for organizations. Its principle expands to a societal level the consideration of objectives pursued by technical approaches such as "Green IT" and confirms their importance.

The Shift Project calls on companies and governments to adopt digital sobriety as a principle of action.

Lower environmental and energy footprints of the digital go through our individual and collective abilities to question the economic and social utility of both our purchasing and consumption behaviors of digital objects and services, and to adapt them in consequence.

Accelerate the awareness of the digital environmental impacts in corporations and public organizations among the general public and the research community.

Include environmental impacts as decision-making criteria when developing policies for the purchase and use of digital equipment. This concerns private as well as public organizations, in both developed and developing countries.

Enable organizations to manage their digital transition in an environmentally responsible manner, with tools and references that enable them to assess the environmental impact of the digital's component of their choices, at different levels of control. Taking advantage of the "Digital Environmental Repository" example, we call for the implementation of a public database (such as French Ademe's carbon impact database) in order to enable stakeholders to analyze their environmental impact.

Undertake carbon audits for digital projects, to include this data into the wider analysis. The supply-side pressure (GAFAM, BATX*) and the GDP growth expectations related to digitalization shall not be the only criteria for the project selections. In addition, the potential economic, environmental and social benefits are greater for developing countries, where infrastructures are yet to be developed.

Improve the consideration of digital systemic aspects in key sectors such as energy, transports, housing, and agriculture-food. Develop an expertise around this approach to accelerate its implementation.

Implement those actions to the European level and with international organizations, given the global scope and economic power of the main digital players.

*GAFAM (Google, Apple, Facebook, Amazon, Microsoft), BATX (Baidu, Alibaba, Tencent, Xiaomi)