LIFE CYCLE ASSESSMENT APPLIED TO DIGITAL SERVICES

Authors and date

- Submitted on: April 13th 2021
- Julie Orgelet - DDemain - LCA and digital responsibility consultant

WHY ASSESS THE ENVIRONMENTAL IMPACT OF DIGITAL SERVICES?

From home to work, from the company to the city and public services, digital services are an integral part of our daily lives and have changed our behavior and consumption patterns. The immateriality of the services offered is increasingly challenged by the underlying materiality of the equipment and infrastructure required by the digital sector. However, the studies conducted over the last ten years on the impacts of such a transformation have focused on specific issues, such as the energy consumption of data centers, the programmed obsolescence of terminals or the management of electronic waste, but have not proposed a holistic approach to the phenomenon.

Since 2018, several publications [1] [2] have enlightened the debate and highlighted the need for a more global approach that is multi-criteria, multi-stage, multi-component, in order to be able to apprehend these complex systems that are digital services since they are the combination of user terminals, datacenters and telecommunications networks, all composed of a multitude of equipment, each with its own life cycle.

Thus, to address these issues, the method of Life Cycle Assessment (LCA) seems the most appropriate.

WHAT IS A LIFE CYCLE ASSESSMENT?

Life Cycle Assessment is an environmental assessment method similar to Carbon Footprinting or Impact Assessment, but it has specificities that make its holistic approach unique. Indeed, used since the end of the 90s and standardized in the ISO 14040: 2006 and ISO 14044: 2006 series, this method proposes to establish the ecological baggage of a product or a service according to an approach:

- **multi-criteria**: several environmental indicators are to be considered systematically through the global warming potential, the depletion of abiotic resources, the creation of photochemical ozone, the pollution of water, air, soil, human ecotoxicity, biodiversity. The list of indicators is not fixed but depends on the sector of activity,
- **life cycle**: in order to integrate the impacts generated during all the stages of the life cycle of the equipment, from the extraction of natural resources which are often not

easily accessible, to the production of waste and the consumption of energy during the use phase,

- **quantitative**: each indicator is quantified in order to be able to put all the externalities of a product or service on the same scale and make decisions objectively,
- **functional**: the object of study is defined by the function it fulfills in order to compare different technical solutions,
- **attributional or consequential**: life cycle analysis allows the direct environmental impacts of a solution to be characterized in the traditional way via attributional life cycle analysis, but also indirect or systemic environmental impacts via consequential life cycle analysis. Nowadays, most of the work has focused on direct impacts, but the subject of digital technology calls for the consideration of impacts on other sectors of activity and on our lifestyles, so consequential life cycle analysis must be developed in parallel.

Even if LCA is initially more applied to the field of products, its scope of action has been expanded in recent years. First of all thanks to the ETSI 203 199 standard and today thanks to the numerous works carried out by the professional organizations of telecommunications such as the ITU, by the NegaOctet consortium for digital services or by the Ecodesign cluster for services in general. This work is now feeding into French regulations, in particular the implementation of Article 13 of the law against waste and the circular economy, which aims to force telecoms network operators to communicate to the general public on greenhouse gas emissions from data transmission.

Moving from a product to a service means keeping the multi-criteria and functional philosophy, but moving from a circular approach (from cradle to grave) to a matrix approach integrating the life cycle of all the equipment making up the three thirds (terminals, networks, datacenters) that enable the digital service to function.

This type of environmental diagnosis makes it possible to avoid the transfer of pollution from one phase to another and from one third of the service to another. For example, when moving from a local solution (installed on the computer such as Microsoft Office 2010) to a SaaS solution in the cloud (not installed on personal computers but on a datacenter accessible via a browser such as Windows 360), the lifecycle analysis will ensure that the impacts avoided at the level of user terminals will not be compensated by additional impacts on the network.

WHAT IS THE PURPOSE OF A LIFECYCLE ANALYSIS?

Generally speaking, performing a life cycle analysis of a digital service means giving it back its materiality and its environmental externalities. It is relevant to apply this method to:

- establish a quantitative diagnosis of the direct environmental impacts of a digital solution
- identify the most significant levers for improvement in view of an ecodesign project

- compare digital and non-digital technical solutions and make recommendations based on technical choices and behaviors
- communicate objectively on performance and service improvements
- manage a responsible digital strategy and integrate the digital services footprint in the companies' reporting

Analysis is a powerful decision support tool for both government and business strategies.

HOW TO DO LIFECYCLE ANALYSIS?

By its iterative nature, the life cycle analysis method adapts to all levels of knowledge of the actors. One can only decide to apply the philosophy, make a quick scoping assessment or look for exhaustiveness by developing a life cycle assessment in accordance with ISO 14040.

The important thing is to respect the 4 steps of the process:
1. definition of the objectives, the functional unit and the scope of the study,
2. life cycle inventory - data collection,
3. assessment of environmental impacts,
4. interpretation and ensuring transparency of assumptions and choices made.

The process of reflection at the origin of the production of the results is itself a vector of awareness for the sponsors and producers of digital services, which allows them to become aware of their impacts and their dependencies on other actors.

LIFECYCLE ANALYSIS, CONCLUSION AND LIMITS

The main advantages of life cycle assessment are:

- to propose a global view of the environmental impacts of the product or service studied,
- to strengthen technical and environmental data scattered throughout a complex and diffuse value chain (the actors are in the 4 corners of the world) and mixing material and human resources.

This approach also has several limitations:

- systemic limitations: when the quantification exercise is carried out, the tendency is often to stop at quantifying the direct impacts of a solution. However, it is necessary to reintegrate the results of the life cycle analysis into a more global ecosystem and to integrate the indirect effects (see concept sheet "The rebound effect") of a solution. Thus, consequential life cycle assessment will have to develop in the years to come to meet this need.
- scientific limits: some environmental indicators lack maturity and poorly reflect the reality of environmental issues associated with digital technology. Indeed, indicators such as biodiversity loss, toxicity, land use, etc. are considered as worrying, but the methods must be completed to ensure that our choices are relevant to the scope of the phenomena

- technical limits: the information to gather to evaluate the environmental impact of a digital service is multiple and relies on a large number of actors with sometimes diverging interests. It is therefore essential to have data that allows the impacts of the entire system to be quantified in a reliable, homogeneous and fair manner. In this context, the databases available to date for the digital sector are incomplete and require significant consolidation and research work. Currently, various initiatives are being undertaken to reduce this gap at the French and international levels.

Finally, life cycle analysis is only a small part of life cycle thinking and can be complemented by social life cycle analysis (S-LCA) and life-cycle cost analysis (LCCA). Two disciplines that would be good to develop in the context of the digital sector.

TO GO FURTHER

- Sofia Benqassem, Frédéric Bordage, Lorraine de Montenay, Julie Delmas-Orgelet, Firmin Domon, Étienne Lees Perasso, Damien Prunel, Caroline Vateau. Digital technologies in Europe: an environmental life cycle approach. GreenIT, 12/2021. Available on GreenIT.fr [consulted on 14/04/2022]
- Frédéric Bordage. Environmental footprint of the digital world [online]. GreenIT, octobre 2019. Available on GreenIT.fr [consulted on 17/03/2022]

SOURCES

1. Lean ICT – Les impacts environnementaux du Numérique – Octobre 2018 – The ShiftProject ↩
2. Empreinte environnementale du numérique mondial – Octobre 2019 – GreenIT.fr ↩
3. ADEME - Analyse comparée des impacts environnementaux de la communication par voie électronique- Volet courrier électronique: Synthèse - Juillet2011 - https://presse.ademe.fr/files/acv_ntic_synthese_courrier_electronique.pdf ↩
4. http://www.greenconcept-innovation.fr/ ↩
5. www.negaoctet.org ↩