

# RECOMMENDATIONS FOR THE LCA OF CONNECTED DEVICES AND SERVICES

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## What is SCORE LCA ?

SCORE LCA is an association created to promote and organize cooperation between companies, institutional and scientific community in order to support the evolution of LCA methods and their practical implementation at European and international level.

## Objectives of the study

- Perform an international state-of-the-art bibliography regarding connected devices LCA
- Perform the detailed analysis of the most relevant publications to identify characteristics, strong and weak points
- Provide recommendations on LCA of digital devices and identify robust data to be used

## Definition and bibliography

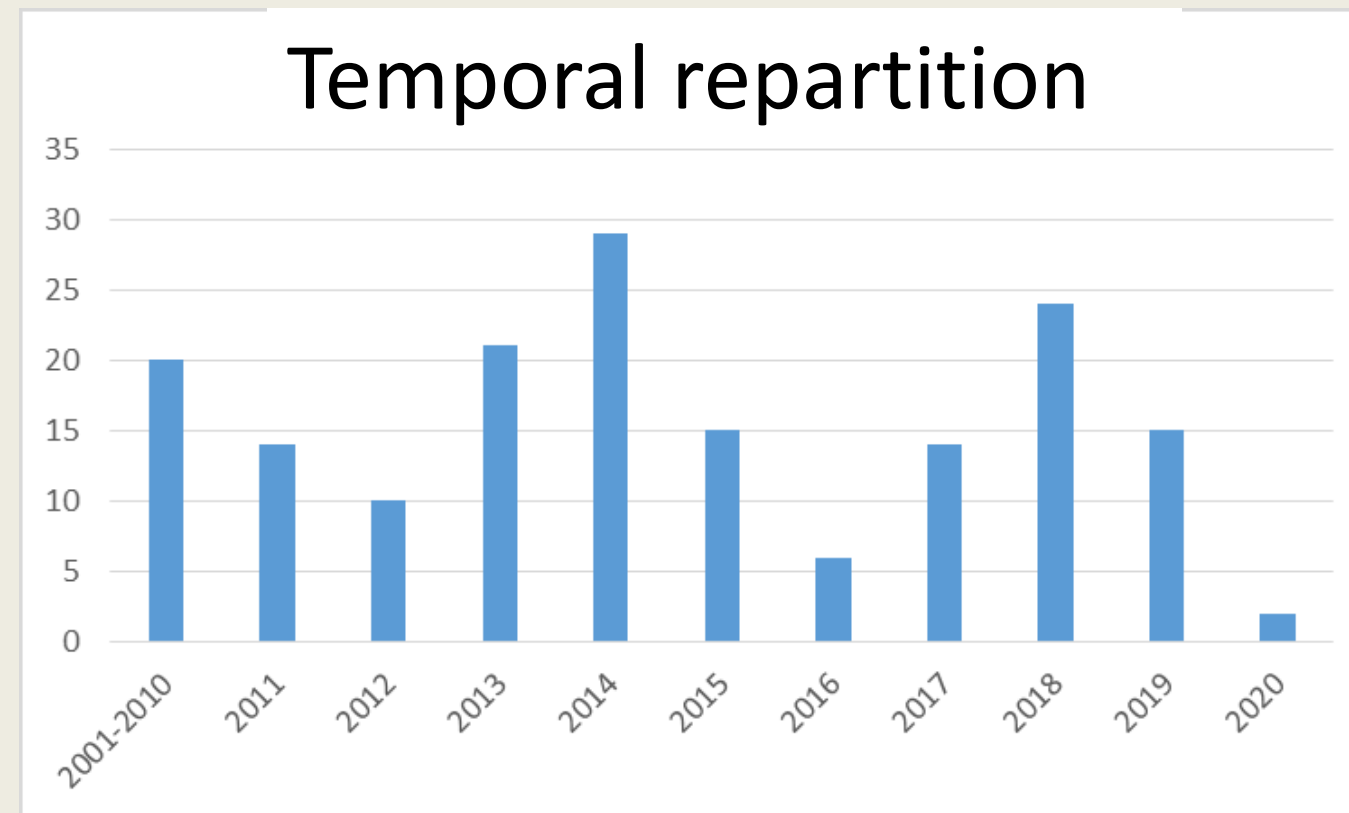
**Digital service : Definition from the Alliance GreenIT:**  
 «A digital service is constituted of a set of software, hardware, networks, infrastructures, and other digital services. It fulfill a functional unit such as «book a train ticket», «send an e-mail to friends», etc.»

**For digital services, 4 components must be studied :**

- o Connected objects
- o Network
- o Datacenter
- o Software

### Bibliography:

- Many publications, but inconsistent temporal repartition
- Weak number of publication in recent years despite a growing interest from the public and governments → latency?



Type of studies	Titre
Technical documentation	8
Survey	2
Environmental study	93
Qualitative method	6
Monocriteria – Carbon footprint	16
Monocriteria– Energy	12
Multicriteria – LCA	46
Multicriteria – Simplified LCA	4
Multicriteria – Energy/Carbon	8
Multicriteria – Energy/resources	2
Preliminary study	4
Method	5
Tool	4
Prospective/Trajectory	10
Good practices	2

- Many studies are LCA or mono/bi criteria
- LCA is the most recognized method, even by monocriteria studies that highlight a lack of resources
- There is a non-negligible number of prospective studies

## Analysis

Four type of documents have been in-depth analysed to answer the following questions :

- Digital services equipment LCA studies
  - How to deal with data heterogeneity in the context of digital services LCA?
- Digital services LCA studies
  - ISO 14040-44: do existing studies conform to the standards? If not, what is the explanation for the difference, and how to learn from that?
- Online video
  - How the fast technological evolution can modify results and interpretation, and how to take that into account?
- Indirect impacts
  - Consideration of digital services indirect impacts

### Main issues identified :

#### Lack of shared hypotheses :

Each document analysed is based on its own hypotheses and methodological rules, without using shared reference documents. Beyond results interpretation and comprehension, this sources heterogeneity leads to the impossibility to perform comparison or macroscopic analyses from published studies without taking into account each assessment and hypothesis. It increases the need for having digital services sectorial rules in order to share homogeneous hypotheses.

#### Lack of primary and secondary data:

Digital services LCA suffer from a lack of primary and secondary data. LCA practitioners, manufacturers and users do not have access to complete information on the global digital services value chain (terminals, networks, datacentres). They are led to use hypotheses and secondary data to estimate lacking information and impacts, but secondary data are also lacking or not shared among all practitioners.

#### Choice of indicators :

Beyond results heterogeneity, adding to hypotheses heterogeneity, most studies choose to limit the study perimeter by choosing impact indicators and life cycle phases with the most available data, being mostly the use phase, the energy consumption and the global warming potential indicator.

That issue constitutes a strong limitation to LCA methodology, by removing two main characteristics of LCA:

- Multi-steps
- Multi-criteria

Published results do not provide an exhaustive view of impacts, even direct impacts, of digital services, and lead to a risk of not identifying potential pollution transfers.

#### There are no study that could be used as a reference :

It is essential to cross-check sources, and to collect information from as large a number of LCA studies and environmental studies as possible, whether global or partial, before using sources as references

## Recommendations for LCA

### Data :

Digital services environmental impacts are generally dependent on the service maturity level, mainly in terms of dimensioning related to users numbers. It is important to evaluate impact variations related to use variation and service dimensioning.

There are two approaches:

- Reality-based determination: the capacity utilisation is determined based on the data collection.
- Hypothesis-based determination: the capacity utilisation is a hypothesis. In this case, it must be displayed, and several hypotheses must be calculated as sensitivity analyses.

### Indirect impacts:

Accounting indirect effects is crucial due to the relative importance of those, both in terms of impact reduction potential (ITT for green) and risk of unwanted impact increase. The order of magnitude of indirect effects if not well known currently.

Those impacts are difficult to quantify with affordable resources and time for most LCA practitioners, and require the intervention of experts from various domains. Nonetheless, it is possible to identify and categorize them. To do so, different classifications are possible.

### Reference flow :

The reference flow concept is complex to adapt to digital service LCA. Additional information must be taken into account.

### Possession and use environmental costs :

When identifying ecodesign strategies, it is recommended to identify impacts caused by acquiring equipment, and those caused by using equipment. The use cost includes the life cycle of network and datacenter equipment, allowing the transport, treatment and storage of data.

### Average and marginal environmental costs :

Two visions are possible:

- Average cost calculation: common LCA calculation: impacts related to the production are allocated to the service based on an allocation factor which depends on each situation
  - Marginal cost calculation: cost linked to the increase of environmental impacts related to the service, compared to the previous situation. Excludes the production of equipment already in use
- In the case of marginal cost calculation, an equipment can have both impacts associated with the service (electricity consumption in active mode), and others not (fabrication, electricity consumption in stand-by).

