

**Louvain School of Management**

# **Study of the implementation of digital sobriety with a view to achieving the SDGs in Belgian organisations**

Authors : PIRONNET Justine, LAUZER Jimmy  
Supervisor : KOLP Manuel  
Academic year 2022-2023  
Final dissertation (TFE) with a view to obtaining the title of  
Master's degree (60) in Management Sciences  
Daytime working hours



## Acknowledgements

This end-of-study work was supervised by our promoter Manuel Kolp, who was able to guide us and give us a better overall view of our problem. We would like to thank him for the time he devoted to us and his always quick answers.

To carry out our work, we interviewed three organisations that were quite different from each other. We would therefore like to personally thank the three speakers who gave us their time to answer our questions on digital sobriety. Firstly, we would like to thank Michel Herquet, founder of the company B12 Consulting, for the time he gave us to answer our interview guide correctly. Secondly, we would like to give special thanks to Jules Delcon, employee of the non-profit organisation Belgian Institute for Sustainable IT. He gave us valuable advice and contributed to our deeper knowledge of the digital world and its environmental impact. Finally, we would like to thank Marc Servais, who was able to provide us with further information on digital sobriety and the case of UCLouvain in transition.

Our last acknowledgement goes to all the academic staff of the LSM that we met during this supplementary master. Thank you for educating us a little more about management and corporate social responsibility. This knowledge is precious and we are grateful for it.

# Abstract

At a time when the impacts of climate change are becoming increasingly frequent, public awareness is growing. This awareness is partly driven by the SDGs and the CSR policies that have been put in place to contribute to the sustainable development of the planet within our society. However, people are not always aware that this digital world also has an impact on our planet and its environment. Indeed, the digital world currently accounts for 4% of  $CO_2$  emissions, and if good practices and more restrictive policies are not put in place, this percentage is likely to increase. The aim of this work is therefore to highlight the consequences and challenges of the use of digital technology in all its forms, within 3 organisations and more generally. This approach has several objectives (1) A better understanding and analysis of IT strategies in the short, medium and long term. (2) A better understanding of the implementation of such a policy within a Belgian organisation. (3) An analysis of the levers and obstacles to this digital sobriety. The interviews revealed the difficulty of implementing a strict policy on an equal footing for all companies in all sectors. For the time being, raising awareness is an important step before a clear digital sobriety policy is put in place in companies, given all the SDGs to be achieved. This work has made it possible to highlight the steps that could be taken to ensure that a policy of digital sobriety is put in place in companies in the years to come, and to gain a better understanding of the issues involved.

# Table of contents

<b>Acknowledgements</b>	i
<b>Abstract</b>	ii
<b>1 INTRODUCTION</b>	<b>1</b>
<b>1.1 Context</b>	1
1.1.1 Evolution from 1970s first approaches to SDGs and CSR	1
1.1.2 SDGs and CSR in Belgium	6
<b>1.2 Technical state of art</b>	8
1.2.1 Definitions of concepts	8
1.2.2 Hardware aspects	11
1.2.3 Software aspects	15
1.2.4 Human aspects	17
<b>1.3 Research question and objective</b>	19
<b>2 METHODOLOGY</b>	<b>20</b>
2.1 Approach and data collection	20
2.2 Data analysis	21
2.3 Organizations and interviews presentations	21
2.3.1 Michel Herquet - B12 Consulting	21
2.3.2 Jules Delcon - Belgian Institute for Sustainable IT	22
2.3.3 Marc Servais - UCLouvain en transition	22
<b>3 RESULTS AND DISCUSSION</b>	<b>23</b>
3.1 Belgian organizations analysis	23
3.1.1 B12 Consulting analysis	23
3.1.1.1 Hardware aspects	23
3.1.1.2 Software aspects	25
3.1.1.3 Human aspects	27

3.1.2	Belgian Institute for Sustainable IT analysis	30
3.1.2.1	Hardware aspects	30
3.1.2.2	Software aspects	31
3.1.2.3	Human aspects	33
3.1.3	UCLouvain en transition analysis	34
3.1.3.1	Hardware aspects	34
3.1.3.2	Software aspects	35
3.1.3.3	Human aspects	37
3.2	Comparison	39
3.2.1	Hardware aspects	39
3.2.2	Software aspects	39
3.2.3	Human aspects	40
<b>4</b>	<b>CONCLUSION</b>	<b>41</b>
	<b>Bibliography</b>	<b>43</b>
	<b>Appendices</b>	<b>50</b>
A	GreenIT analyses	50
A.1	B12 Consulting	50
A.2	ISIT Belgium	51
A.3	UCLouvain	52
B	Interview guide	53

## List of Figures

1.1	Effect of the Montreal Protocol on GHG emissions [1]. . . . .	2
1.2	The Millenium Development Goals to be reached by 2015 [2]. . . . .	3
1.3	IPCC report on the impact of human activities on climate change [1].	4
1.4	The Sustainable Development Goals [3]. . . . .	4
1.5	GHG emissions of manufacturing things in [kgCO <sub>2</sub> eq.] [4]. . . . .	9
1.6	GHG emissions of everyday things in [kgCO <sub>2</sub> eq.] [4]. . . . .	9
1.7	Life cycle of any device with an eco-conception [5]. . . . .	11
1.8	Repartition of CO <sub>2</sub> emissions by digital sector per person per year [6].	16
1.9	Digital share of global GHG emissions including or excluding sobriety [7]. . . . .	18
3.1	Criteria for an eco-designed site where the yellow square represents the B12 Consulting's score. . . . .	27
3.2	Criteria for an eco-designed site where the yellow square represents the ISIT Belgium's score. . . . .	32
3.3	Criteria for an eco-designed site where the yellow square represents the UCLouvain's score. . . . .	36
A.1	Good practices analyse for B12 Consulting . . . . .	50
A.2	Good practices analyse for ISIT Belgium . . . . .	51
A.3	Good practices analyse for UCLouvain . . . . .	52

## List of Tables

1.1	Reparability index highest/weakest score.	13
3.1	Summary of the hardware aspect at B12 Consulting.	25
3.2	GreenIT Analysis of the B12 Consulting's web site.	26
3.3	Summary of the software aspect at B12 Consulting.	27
3.4	Summary of the human aspect at B12 Consulting.	29
3.5	Summary of the hardware aspect at Belgian Institute for Sustainable IT	31
3.6	GreenIT Analysis of the ISIT Belgium's web site.	32
3.7	Summary of the software aspect at ISIT Belgium.	32
3.8	Summary of the human aspect at ISIT Belgium.	33
3.9	Summary of the hardware aspect at UCLouvain en Transition.	35
3.10	GreenIT Analysis of the UCLouvain's web site.	36
3.11	Summary of the software aspect at UCLouvain en Transition.	36
3.12	Summary of the human aspect at UCLouvain en Transition.	38
3.13	Comparison of the ecological footprint of different websites.	40

# 1. INTRODUCTION

## 1.1 Context

In the last decade, it is common to hear in the news about climate change, emergency or crisis. If this seems now so clear as a problem, it is because there has been a phase of evolution of knowledge and awareness among the population about it. Numerous expert reports and international conferences have led to the definition of sustainable development and other underlying concepts such as corporate social responsibility.

This section will serve to trace the evolution and awareness of sustainable development. The approach will be made by applying an increasing focus on the case of Belgium and then on the contribution of digital technology.

### 1.1.1 Evolution from 1970s first approaches to SDGs and CSR

The various industrial revolutions and the evolution of agricultural practices have led to a great boost in economic development but also in the human impact on the planet. The first scientific publications critically addressing the limits of this growth, which was previously infinite, date from the 1970s. In 1972, Meadows *et al.* published "The Limits to Growth", which takes a critical look at the link between development and the environment. That same year, the United Nations Conference on the Human Environment took place in Stockholm, which symbolized the first meeting devoted to the issue of environmental protection [8].

Thereafter, studies and works in the field followed one another. The expression "sustainable development" was used in the report of the United Nations Commission on Environment and Development chaired by Gro Harlem Brundtland. This report, published in 1987, popularly known as the "Brundtland Report" and its real title

"Our Common Future" defines sustainable development as it is acknowledged today by linking not only the environmental dimension, but also social conditions, peace, security, etc. Also in the same year, the Montreal Protocol was signed by all the countries of the world. The question of the real efficiency of the different protocols, conferences or other can be asked. Nevertheless, one can see in Figure 1.1, the positive consequences of the Montreal protocol on the greenhouse gas emissions [9].

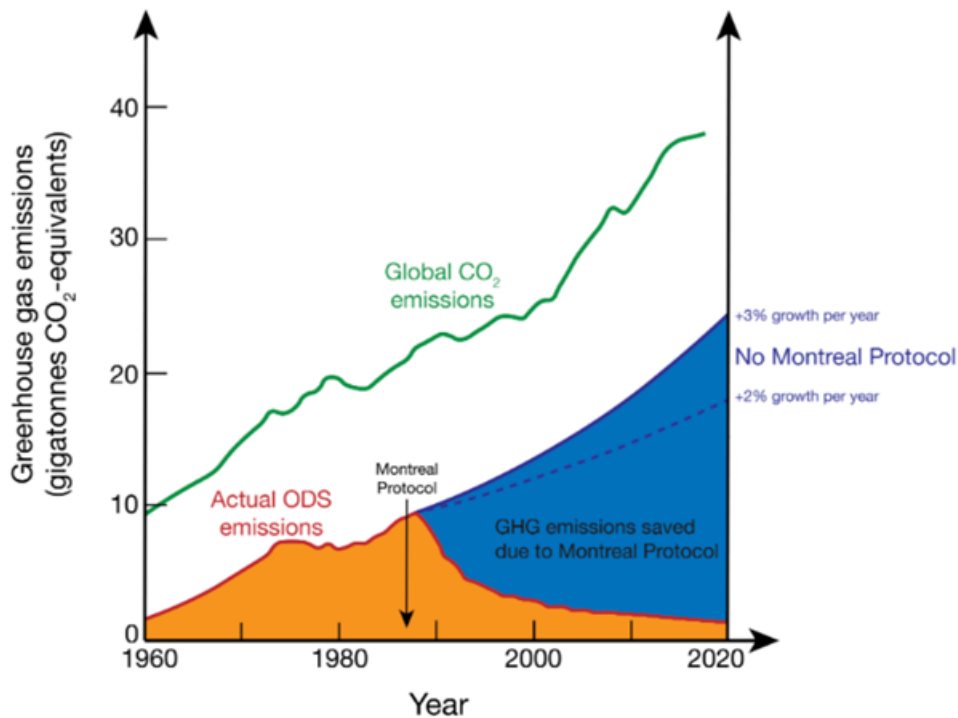


Figure 1.1: Effect of the Montreal Protocol on GHG emissions [1].

In 1997, the Kyoto Protocol was signed at the COP3. It is an international agreement to reduce greenhouse gas emissions. Indeed, it aimed to reduce, between 2008 and 2012, by at least 5% compared to 1990 levels, the emissions of six greenhouse gases: carbon dioxide, methane, nitrous oxide and three substitutes for chlorofluorocarbons (CFCs) [10].

The passage to the year 2000 marks a major turning point in the progression towards sustainable development. In New York took place the adoption of the Millennium Development Goals (MDGs). This was formalized in the United Nations Millennium Declaration by 193 UN member states who agreed to achieve them by 2015. This gathering has not only the climate goal in its sights, but also other humanitarian issues. The eight MDGs are listed in Figure 1.2 and are detailed with several sub-targets on the UN website [11].



Figure 1.2: The Millenium Development Goals to be reached by 2015 [2].

At the end of the Millennium Development Goals in 2015, international leaders had to re-launch programs to mobilize the joint efforts of the world’s different countries and organizations. This led to the Paris Agreement, a legally binding international treaty on climate change. Its main objective is to limit global warming to 1.5 degrees Celsius, compared to pre-industrial levels, with the aim of achieving a climate neutral world by 2050 [12]. This requires the 196 signatory parties to reduce their respective greenhouse gas emissions. This is the main cause of global warming as shown in Figure 1.3 coming from a study of the impact of human activities by the IPCC (Intergovernmental Panel on Climate Change).

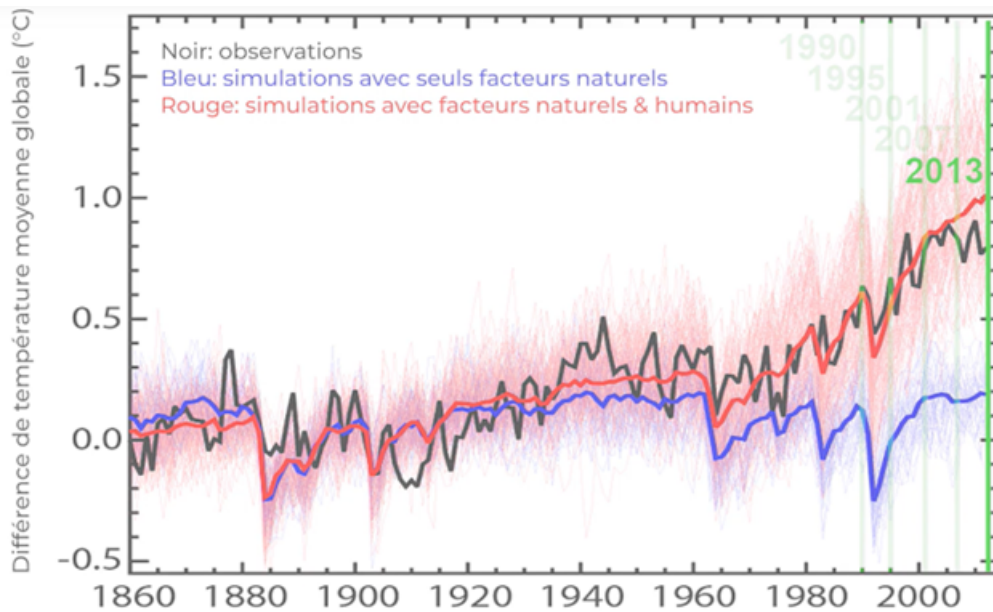


Figure 1.3: IPCC report on the impact of human activities on climate change [1].

In 2015, the Sustainable Development Goals (SDGs) were published to replace the expired Millennium Development Goals. This time, there are 17 objectives (Figure 1.4) broken down into 169 underlying targets that can be measured using 242 indicators. They are intended to continue the mission of the MDGs by considering their status and complementing them. The SDGs have been signed by all members of the United Nations, who are committed to achieving the goals by 2030 [3].



Figure 1.4: The Sustainable Development Goals [3].

Around the world, efforts are being made to achieve the SDGs, but results vary by country and specific goals. Many countries have integrated the SDGs into their national policies and developed strategies to implement them. Progress has been made in areas such as reducing extreme poverty, increasing access to education, promoting gender equality, and combating climate change. However, challenges remain, including inequality, environmental degradation, and access to basic services in some regions. The main constraint to the achievement of the SDGs is the COVID-19 pandemic, which for some monitors has even caused a regression from the 2015 start date. The status of the SDGs is included in the UN's annual report on the subject [3].

Another concept that has emerged with regard to business development is Corporate Social Responsibility (CSR). It has been defined in order to question "the *raison d'être*" and the purpose of companies. In fact, Milton Friedman, an American economist, considered one of the most influential of the 20th century, described the objective of a company as maximizing profit for its shareholders, while respecting the law and morality in force. It is understood that any legislation or ideology with a social vocation is perceived as a constraint with a purely financial objective.

In contrast, Emmanuel Faber, CEO of the French multinational Danone, defines a company's primary objective as creating shared value for all stakeholders, including employees, customers, suppliers, local communities and the environment. According to him, the company must be a driver of sustainable development by taking into account the social and environmental impacts of its activities. The constraint for him will be to satisfy the shareholders sufficiently in the realization of the activities. Therefore, CSR encompasses all the impacts, whether environmental, social or human, that a company has on all its stakeholders, not just the shareholders. This means that all individuals/groups that can affect or be affected by a company's activities must be taken into account in company strategies. In the context of companies/organizations, CSR can be a tool for achieving the SDGs by minimizing the negative impacts of companies [13].

### 1.1.2 SDGs and CSR in Belgium

Obviously, it is not possible to properly focus on the SDGs at the national level using the global report, as the state of progress between certain regions is so heterogeneous. For this reason, the European Union itself is presenting a preliminary report on the state of progress within the EU.

In Belgium, there are several organizations that aim to report on progress on the SDGs, while motivating to keep the initial commitments. The Institut Fédéral pour le Développement Durable (IFDD), placed under the authority of the Minister of Sustainable Development, aims to strengthen the federal policy on sustainable development by anchoring sustainable development at the center of government policy. The IFDD publishes a sustainability report, the latest of which is from 2015-2016 and explains a series of strategies around the 17 SDGs and the 2030 Agenda. The IFDD also chairs the Commission Interdépartementale pour le Développement Durable (CIDD), which is composed of representatives of all federal government agencies and the Department of Defense. The CIDD prepares an annual report on the activities of the commission, which serves to prepare and coordinate the follow-up of the actions of the federal public services in the field of sustainable development [14].

In addition to governmental organizations, other actors in society are reporting on the progress of sustainable development and the SDGs. Indeed, Antwerp Management School, the University of Antwerp and UCLouvain took the initiative in 2018 to develop a barometer measuring the adoption of the SDGs in Belgium. This initiative is supported by the IFDD and is in its third version in 2022. For this latest version, a total of 129 complete responses were collected, evenly split between Flemish and Walloon organizations (48.84% vs. 51.16%). These respondents included companies (50%), governmental organizations (20%), non-governmental organizations (10%), educational organizations (5%) and other types of organizations [15].

One might ask what impact the COVID-19 crisis has had on the achievement of the SDGs. The barometer indicates that "Only 1 in 3 organizations said COVID-19 has had a delaying effect on SDG process, mostly due to different priorities". This is because they can only improve organizational resilience and survival. The main motivations come from a growing interest in the societal impact of a company's activities and the connection with business priorities. The main obstacles stem from the lack of awareness of the SDGs among stakeholders, both internal and external.

The 5 SDGs prioritized in Belgium by the companies are the following:

1. SDG 13 : Climate action
2. SDG 3 : Good health and well-being
3. SDG 8 : Decent work and economic growth
4. SDG 7 : Affordable and clean energy
5. SDG 12 : Responsible consumption and production

Digital technology makes a significant contribution to the world's carbon footprint. Indeed, it is estimated that in 2021 the global carbon emissions attributed to the ICT sector is between 1.8 and 3.9% [16]. Digital technology is an integral part of our society today and contributes directly to the achievement of the SDGs. However, if we focus on the impact of companies, we can see that the ICT sector affects the podium of prioritized SDGs in Belgium. Indeed, it affects SDG 13 (climate action) by having a direct carbon footprint. Then, SDG 3 (good health and well-being) is also concerned by the social aspect of the SDGs because a large part of the population is regularly working with digital tools. Finally, it obviously affects SDG 8 (decent work and economic growth) because the ICT sector generates a significant activity in developed countries such as Belgium.

## 1.2 Technical state of art

In this section, the aspects and concepts surrounding digital sobriety will be described. This part will therefore focus on the definitions of some concepts in a broad sense, but also on the hardware, software and human side of this dimension.

### 1.2.1 Definitions of concepts

To better understand all the concepts included in this work, it is useful to clearly define the notions related to digital sobriety and sustainability.

To introduce digital, one can first define this *digital world*. Digital is not just about social networks. Indeed, in 2019, the world disposed about 34 billion devices. This includes computers, monitors, data centers, etc. Digital can be divided into three parts : the users, the data centers and the networks that connect the other two. But this world of many thousands of devices consumes energy, even if it doesn't seem obvious. It was only in the 1990s, when people became aware of the environmental impact of IT devices, that green computing was born. *Green computing*, or *digital sobriety*, was born in 1992 and aims to reduce the ecological and environmental footprint of computers and servers. Although it is not visible, digital technology has a negative impact on the environment. Every aspect of digital technology has a carbon footprint, and green computing therefore seeks to reduce this impact as much as possible.

To better understand why digital sobriety is significant, it is important to quantify and list impacts on the environment. Digital technology alone represents a seventh continent, and its contribution to humanity's footprint is not insignificant. Greenhouse gas emissions amount to 3.8 %, water consumption to 0.2% and primary energy consumption to 4.2%. Moreover, energy consumption is increasing by 9% every year. The digital sector is estimated to account for between 1 and 2% of global consumption. One can also take into account the electronic waste which represents more than 50 million tons per year, where only 17% is recycled correctly. Finally, the materials used to manufacture electronic devices are sometimes rare and precious metals, and the impact of manufacturing is significant as can be seen in Figure [1.5](#) [\[17, 18\]](#).

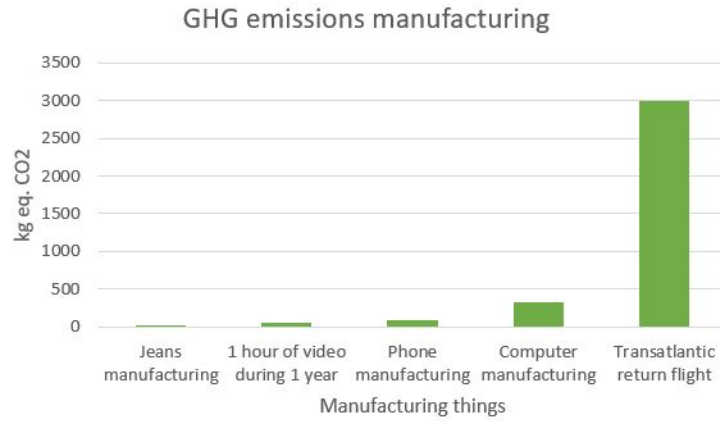


Figure 1.5: GHG emissions of manufacturing things in [kgCO<sub>2</sub>eq.] [4].

It is therefore important for companies (and individuals) to be able to quantify the environmental impacts of both hardware and software. Even if it is easier to imagine the impact of the hardware, the software is not to be neglected at all. This is what it is called the digital carbon footprint. Each data transfer consumes energy and it can be useful to give it an order of importance. Indeed, with a better understanding of the amount of energy emitted by digital technology, it is possible to put in place good practices to go from a 9% increase in consumption to only 1.5%. To get an order of magnitude of digital consumption, a common metric to measure greenhouse gases emissions is the mass of equivalent carbon dioxide [kgCO<sub>2</sub>eq.]. When observing the impact of one hour of video viewing, one can see on Figure 1.6 that it represents 0.13 [kgCO<sub>2</sub>eq.] 20km by car, on the other hand, has a consumption of 6 [kgCO<sub>2</sub>eq.] [4].

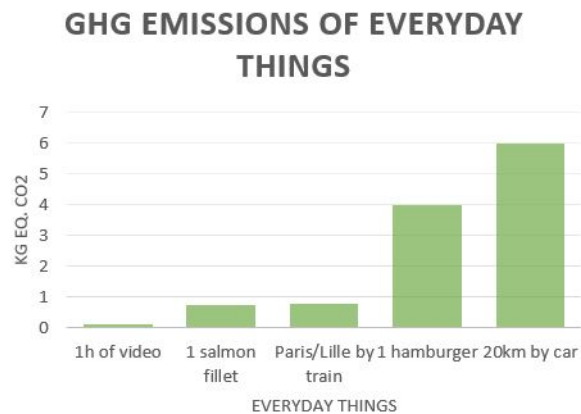


Figure 1.6: GHG emissions of everyday things in [kgCO<sub>2</sub>eq.] [4].

To achieve this green computing, companies are developing servers, peripherals and other strategies to achieve the lowest energy consumption and thus optimise digital tools. There are many green computing strategies : teleworking, data center management, powering down devices, choice of computers, etc. However, green computing starts at the beginning of the production chain, not only when the product is in the hands of the company. Indeed, manufacturers can improve the energy efficiency of the chips in IT devices, choose better components for their devices in order to opt for the best product life cycle. The reason why these strategies exist is that there are benefits to following them. In addition to reducing the climate impact, it also reduces the company's overall carbon footprint and lowers the company's costs. However, there are still many barriers to green computing. In addition to the lack of interest in green IT, the rapid changes in technology and the desires of individuals based on their personal demands add further barriers [19, 20, 21].

Companies that implement practices to limit their environmental footprint will then generally communicate this to the general public. There can be several reasons for this : to have a brand image, to make themselves attractive to their clients or future clients, to attract young talent to their company, etc. However, it is important to be careful about how to communicate these actions. Indeed, companies can fall into *green washing*. Green washing is in fact a fraudulent technique to promote a more responsible and ethical image of the company, when it is not really. It can then be detected in several forms: evasive speeches, in product labels, a colour that makes you think of ecology, a lexicon that is too "green" without any real figures or evidence behind it. This green washing is an obstacle to the transition to a more ecological digital world. To counteract this green washing, regulations have been introduced in recent years. In addition, since 2023, the European Commission is creating the Green Claims Directive project which will better regulate all these misleading claims. "From now on, in order to communicate or advertise in environmental matters, it will be necessary to be able to provide clear proof of its claims. There are many ways to understand the ins and outs of marketing without green washing. ADEME offers a guide<sup>1</sup> for any company wishing to communicate in a responsible and ecological manner.

---

<sup>1</sup><https://communication-responsable.ademe.fr/antigreenwashing>

## 1.2.2 Hardware aspects

To put it in context, hardware is all the material, mechanical or electronic equipment used in the manufacture of computers and other technologies, commonly called machines.

When talking about hardware, one can think first of all about its design. Indeed, it takes many materials to build a single machine, and also a lot of upstream natural resources to produce them. To minimize its impact on the environment, one can then look at the eco-design of these products. This means not only manufacturing machines in a more sustainable way, but also machines that are more easily repairable or have a longer lifespan. But when designing a product, one can't solely think about the manufacturing process itself. All stages of the product's life cycle must be taken into account. The different stages of eco-design are the following [22] :

1. Manufacturing
2. Product life(s)
3. E-Waste treatment and recycling



Figure 1.7: Life cycle of any device with an eco-conception [5].

The manufacturing stage is the part with the biggest environmental impact. Indeed, the carbon impact of the design can vary, but it is well over 50 percent in all cases.

In addition, the construction of these machines involves many metals and minerals, some of which are quite rare such as gallium, germanium or indium. It should also be noted that the extraction of these materials has a significant energy consumption, and that this extraction leads to a much greater extraction of material than required [23, 24].

Once the product is manufactured, it will be transported and then purchased by a consumer. The environmental impacts of using electronic devices can be found in Section 1.2.1. After some time, the device starts to show signs of wear and tear and/or the consumer feels inclined or encouraged to buy a new product due to various obstacles. Indeed, with the daily technological advances and the increasing number of updates, the lifespan of electronic devices tends to decrease, which leads to over-consumption. This over-consumption is caused by so-called obsolescence, which means that a durable product is no longer used in its original function, whether or not it is still technically functional. Obsolescence is said to be organized when it is induced by the manufacturer who, in order to increase his sales, deliberately reduces the life span of his products. There are several forms of organized obsolescence, described below with increasing acceptability [23, 25]:

1. *Programmed* :
  - (a) Lifetime limit
  - (b) Irreparability
  - (c) Incompatibility old/new
2. *Accelerated* :
  - (a) Incremental innovation
  - (b) Improved performance
3. *Perceptual* : mode

The consumer then has several choices : repair it, resell it to give it a second life or send it back to the manufacturer who will recycle and/or recondition it [23].

The first option, reparability, measures whether a consumer is inclined to repair and maintain their electronic products. It includes the possibility to dismantle the device, to replace parts but also the information made available to be able to repair it.

Repairability is gaining momentum around the world as it opens up a more circular economy. Despite this craze, there are several obstacles to this reparability [26] :

1. Safety : it must be possible to guarantee reliable repairs
2. Obsolescence
3. Capacity : skills are needed
4. Intellectual property : this can threaten confidential device designs

To combat these obstacles, Belgium has set up an action plan to promote sustainable consumption. A reparability index will soon be introduced, based on 5 criteria : documentation, disassembly and access, availability of spare parts, price of spare parts and specific criteria. To give concrete examples, the brands with the highest and lowest reparability index in certain areas can be found in Table 1.1 [23, 26, 27].

	Weakest score	Highest score	Mean score
<b>Computer</b>	3.5 (Microsoft)	9.0 (Lenovo)	6
<b>TV</b>	3.2 (Continental Edison)	8.5 (Samsung)	7.3
<b>Phone</b>	1 (KXD)	9.6 (Athesi)	6.5

Table 1.1: Reparability index highest/weakest score.

Another possible solution is to recycle via the resale of the device. There are countless platforms for reselling one’s machine still in condition to give it a second life. This is what is called re-use.

Finally, the third option is to recondition it. Reconditioning offers several advantages. Firstly, buying refurbished undoubtedly allows you to make savings that can vary between 20 and 70% depending on the grade of the device [28].

Three grades exist:

1. *Grade A* : near new condition
2. *Grade B* : some superficial scratches
3. *Grade C* : scratches or impacts visible to the naked eye

By using refurbished products, the environmental impact is greatly limited. As an example, when buying a refurbished phone, 80% of  $CO_2$  emissions are avoided. For a mobile phone, this can go up to 90%. Using refurbished products can also have a positive impact on the company’s image.

But reconditioning also prevents too much electronic waste. Indeed, at the end of the machine's life cycle, also called electrical and electronic equipment (EEE), EEE becomes waste electrical and electronic equipment (WEEE). Reconditioning of WEEE allows the device to be returned to its original state by deleting data and applications, replacing worn parts or resetting the operating system. Therefore, reconditioning is not the same as reuse, as reconditioning implies that the EEE has become WEEE and has been collected for repair. Reconditioning therefore extends the life of the product and therefore reduces WEEE. It also allows users to buy new products at lower prices. Although refurbishing has many advantages, today only 11% of appliances are sold as refurbished. It is hoped that in the future there will be a strong growth due to collective awareness [28].

Therefore, one can ask where does this E-waste go. E-waste is growing year on year due to incremental innovation and obsolescence as explained above. Between 2015 and 2019, waste increased by 21 percent to a total of 53.6 million metric tons and this increase is not likely to decrease. Only 17.4 percent of WEEE was recycled in 2019 worldwide. The problem is related to error sorting. This waste ends up in the household waste and is considered as non-hazardous [29, 30, 31].

This can have several impacts:

- They end up in landfills where they are buried. This can lead to environmental risks due to the presence of toxic and hazardous substances in electronic devices, such as lead or mercury.
- They are exported to developing countries often under the pretext of reuse or recycling. This e-waste is often poorly managed, dismantled in an informal way and can cause significant environmental pollution and health risks.
- It is incinerated without care : Some e-waste may be incinerated, either intentionally to remove unwanted components or in municipal incinerators. Uncontrolled incineration can result in the release of toxic substances into the air and environmental pollution.

### 1.2.3 Software aspects

Software describes the program that allows computers and other electronic devices to operate via runtime tasks and to process data correctly. To create such software, there are many steps to take to get to its final design [32].

First of all, there is the "before" phase of the project, where a look is given at whether the need of such a service/software before creating it. Indeed, everything that can be avoided is to be avoided, because it will pollute less. It is estimated that between 50 and 80% of software is never used (or very rarely), yet it consumes.

Once the need has been established, comes the design phase. At a time when responsible digital technology is becoming increasingly important, it is important to know that it is possible to make eco-designed software by thinking about more sober interfaces or by reusing existing software. Indeed, there is a lot of software available to the public, called open source. Anyone can view, modify and distribute the code as they wish. Open source software will have the great advantage of increasing the lifespan of the hardware to which it belongs through greater reparability [33, 34, 32].

Then, comes the implementation phase, i.e. the phase in which there is coding. Several factors come into play to have a greater or lesser impact on the environment [35, 32]:

- *The choice of language* : not all languages consume the same amount of energy. Among the least voracious languages, one find C in first position, followed by Rust, C++, Ada and Java in fifth position.
- *The developer's skills* : even if the language is more ecological, if the developer does not optimise his code, it will consume more energy.

Once the realization and testing are finished, the after phase remains. Part of this is the choice of a good data center. A data center is a centralised location where data and IT services are stored, managed and processed. They must therefore be secure and have a reliable power source. There are three types of data centers [32] :

1. *On-site* : the data is therefore hosted on site
2. *In the cloud* : used by several clients, but not on their sites

3. *Managed* : the client company rents dedicated servers, storage and networking equipment from a supplier who manages the data for the client

In order for the data center to function properly, it needs first and foremost electrical power, which can reach megawatts very quickly. In addition, data centers produce heat. This means that these data centers must be cooled continuously because they operate 24 hours a day, every day. As a result, data centers represent the second largest source of digital GHG emissions as shown in Figure 1.8 [36].

### CO2 EMISSIONS BY DIGITAL SECTOR PER PERSON PER YEAR

■ Network ■ Data centres ■ Manufacturing ■ Usage

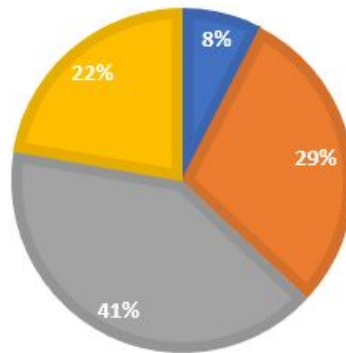


Figure 1.8: Repartition of CO<sub>2</sub> emissions by digital sector per person per year [6].

And if they consume so much, it is not by chance. In fact, they use 2% of the world's electricity. Companies can therefore limit their impact by choosing a data center [37, 38] :

- Powered by renewable energy : this can mean cooling with rainwater, recovery of wasted energy, etc.
- Certified by an ecological label such as ISO14001<sup>2</sup> or 50001<sup>3</sup> or the label "Code of conduct".
- Close to the company : the closer the data center, the shorter the data transport.
- Check the PUE indicator.

Finally, when the software comes to an end, it should be processed. This can be done by saving it in the Software Heritage digital heritage platform.

<sup>2</sup>Dedicated to environmental management

<sup>3</sup>Dedicated to energy management

## 1.2.4 Human aspects

When talking about digital sobriety, the human aspect must also be taken into account. Indeed, at a time when technology is everywhere, several questions can be asked. What are the best practices to put in place for greater digital sobriety ? But above all, how can we become aware of the impact that this can have ?

Although awareness of the environmental impacts of digital technology is growing, it is not enough. Responsible digital technology is a real challenge, which also begins with education. It is therefore essential that education takes up the theme of digital sobriety. However, digital literacy education is rare. So far, no studies have asked citizens about digital frugality and environmental impacts. Instead, research shows that young people have little knowledge of the impacts of their daily digital use. In order to raise awareness among the population, three axes must be taken into account [39]:

1. Analyse the impact of our digital lifestyles on the environment: we need to understand the impact before we really want to change our lifestyles.
2. Search for alternatives to protect the environment.
3. Act, in the form of good practices, for digital sobriety.

If individual awareness is growing, it will be less difficult to find these good practices also in companies or at work. There are countless good practices for moving towards responsible digital business. There are some examples such as watching videos in low definition, giving preference to reconditioned products, eco-designing the computer site, reducing video conferences, etc [40, 41].

Without stronger digital sobriety and collective awareness, GHG emissions will continue to rise as shown in Figure 1.9.

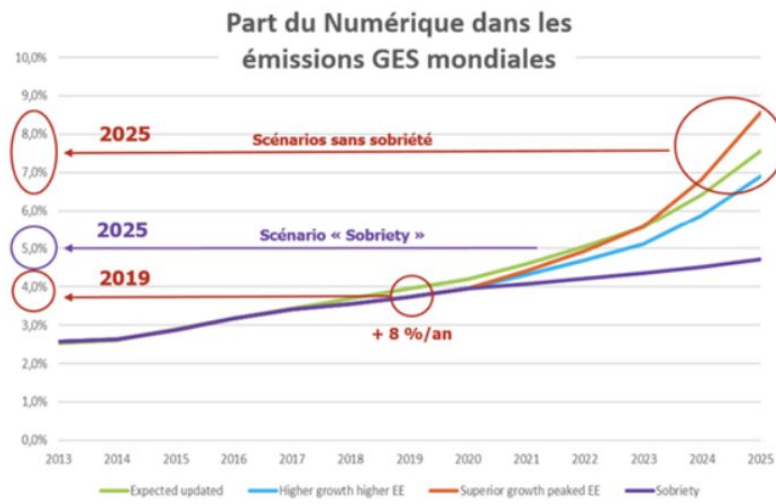


Figure 1.9: Digital share of global GHG emissions including or excluding sobriety [7].

### 1.3 Research question and objective

It is now indisputable that the concerns around sustainable development are to be fully considered in the strategies of companies or organizations in Belgium and in the world. The approach can be applied in various fields, including digital. Many concepts such as Green IT or digital sobriety have been developed in the state of the art.

It is encouraging to realize that theoretical research is progressing to provide the necessary tools for a sustainable digital transition. Then, it would be relevant to investigate the implementation in different types of organizations in Belgium. Hence, for this project, we decided to investigate:

- The development of sustainable short-, medium- and long-term IT strategies.
- The implementation of digital sobriety and good practices on several aspects such as hardware or software.
- The levers and obstacles to improvement in this area of the organization.

To this end, interviews were conducted with different types of Belgian organizations, namely: an IT consultancy SME, a non-profit organization offering sustainable IT consulting services and the sustainable development branch of an academic institution. The variety of organizations will ensure that we have a more global view of the problem, while allowing a comparison of similarities and differences in viewpoints.

The final goal will be to make a synthesis of the improvement paths in the sights of Belgian organizations according to their contribution in the transition to a sustainable digital world.

## 2. METHODOLOGY

### 2.1 Approach and data collection

Belgian organizations were contacted to interview them. The interviews lasted approximately one hour on average. These were conducted in a semi-directive interview format.

The choice of the interview technique is justified by the guarantee of a certain guideline allowing us to address all the desired themes. That said, it leaves a lot of freedom for the interviewer to express themselves in detail while leading the discussion and redirecting if necessary. This happens when the answers go outside the expected framework, although they are very often interesting.

Nevertheless, it is this freedom of response format that makes it possible to detect specificities and define biases in the comparison between interviewees. A general interview guide was therefore written, but adaptations were made in real time according to the progress in the interview, the obtaining of elements of response and the specificity of the organization. The following questions were asked of each speaker :

- Can you introduce us to your company?
- What are the levers and obstacles to the implementation of good/better environmental practices in your company?
- When you select your electronic equipment, what criteria do you take into account to differentiate between two products?
- Once this equipment has reached the end of its life, what do you do with it?
- At the software level, what are the things you do to reduce your energy consumption and your impact on the environment?

- In your company, what are the internal actions/policies you are implementing to have a positive impact on the planet?
- (Possible additional questions)

## **2.2 Data analysis**

To analyse the data, each company was considered independently. Therefore an analysis of the results was conducted for each of the three aspects: hardware, software and human. This technique allows to distinguish and deepen each of the three aspects. Indeed, it is possible to operate at many levels, but by dividing it into the three very different areas, that allows to better differentiate the different practices to be put in place. After that, a comparison will be made between each speaker in order to see the disparities and the common points of each one, which will then be analyzed.

This analysis will be done in text form, and the important points will then be summarised in a table at the end of each interview. The same approach will be used for the comparison between the three organisations. A tool called "GreenIT Analysis" was used to calculate the EcoIndex of websites [42].

## **2.3 Organizations and interviews presentations**

### **2.3.1 Michel Herquet - B12 Consulting**

B12 Consulting is a consulting company, considered a small SME, specialized in IT service management. Founded in 2012, it now has 38 employees and a revenue of € 1.7M for a net profit of € 127,000 in 2022. Its three founders, Michel Herquet, Geoffroy Piroux and Vincent Boucher met during their PhD thesis at the Institute of Theoretical Physics of the UCLouvain. After graduating, the three friends decided to embark on an entrepreneurial adventure together and founded B12 Consulting in Louvain-la-Neuve. The company's business is focused on artificial intelligence and everything around it, i.e. algorithm development, model training, data science, software development to integrate AI, interface design for AI results.

The choice of this organization seemed relevant to us because their business sector is the IT sector, and their source of revenue comes directly from digital.

### **2.3.2 Jules Delcon - Belgian Institute for Sustainable IT**

Jules Delcon is, as he describes himself, a sustainable business developer at the Belgian Institute for Sustainable IT. He graduated in economics and management at UCLouvain and dedicated his master thesis to digital sobriety in Belgian SMEs. For his work, he contacted his future employer before joining their ranks after his graduation. It is a non-profit organization offering consultancy services to companies in order to improve digital sustainability. They offer trainings, webinars, energy audits, best practice guides, etc. They are four direct collaborators and their specificity is that they never go to the customer's place to train them rather than doing the job for them. They are surrounded by a panel of expert partners such as professors David Bol and Jean-Pierre Raskin from the UCLouvain.

The choice of this organization seemed relevant to us because the nature of their services is distinguished by the will to make digital more sustainable in Belgium and in the world.

### **2.3.3 Marc Servais - UCLouvain en transition**

Marc Servais is in charge of sustainable development at the "Service d'analyse, stratégie et propositivité (SASP)" at UCLouvain. He is an expert in urban and spatial planning. He previously worked as an external auditor at the European Commission and as a research assistant at the "Centre d'étude en aménagement du territoire" of UCLouvain. He is currently assisting the "Transition and Society" prorector Marthe Nyssens in the elaboration, the implementation, the coordination, and the follow-up of the "sustainable development" plan of UCLouvain. The conception of the transition plan began in 2020 and was signed in 2021. The plan involves about 40 direct collaborators and calls on many more, such as expert advice from academic staff. It has several components such as energy, mobility or consumption (where IT is considered) and works on the implementation of 91 actions listed in their annual report.

The choice of this organization seemed relevant to us because universities must set an example for sustainability, not only through their academic training, but also through their actions.

## **3. RESULTS AND DISCUSSION**

### **3.1 Belgian organizations analysis**

In this section, we will summarize the responses of each organization and then analyse them.. The aim is to identify the actions already underway for the transition to digital sobriety, but also to identify possible improvements and the views of each stakeholder. We will therefore divide these interviews into hardware, software and human aspects. We will investigate the strategies put in place within the organisations, the implementation of good practices and finally the obstacles and levers to improve them.

The general questions we asked to the various stakeholders can be found in the section [2.1](#).

#### **3.1.1 B12 Consulting analysis**

##### **3.1.1.1 Hardware aspects**

On the hardware side, there are several things to note. The choice of equipment is made according to two criteria : robustness and performance, with an advantage for robustness. They do not particularly look at the ecological scores of the machines. They do not use refurbished equipment either, as it is not suitable for their projects. Their choice of machines therefore turned to the giant Apple. All computers and phones come from this brand. Their reason is that these are the most powerful devices with an acceptable lifespan. They have already thought about the fair-phone, but they say that the performance is not ideal. In fact, technology is one of the obstacles to hardware and digital sobriety. They are not against a more ecological alternative, but they say they do not find the same performance as in an Apple device.

When these machines reach the end of their life cycle within a department of the company (i.e. developers who need high-tech machines), there is a linear recycling

within the company itself. Machines that are not good enough for the most IT-intensive sector will then find their way to another department where high-tech is not the main focus (i.e. secretary). Once these machines are no longer of interest to either sector, they are donated to charity.

It is clear that Apple can be subject to a lot of controversy when it comes to the environment. Indeed, the giant emitted in 2022 no less than 22.5 million tons of CO<sub>2</sub> emissions, which is as much as the total emissions of the city of Paris, and the emissions are mainly linked to the manufacturing of their products (70%). Yet the world-famous brand is making great efforts to reduce its impact by switching to green energy and low-carbon materials. Despite these efforts, other negative points remain. Indeed, the problem of programmed obsolescence is not going to go away. Apple makes sure that their customers regularly change their phone via updates that make the old versions obsolete. In addition, the repairability of Apple devices is also a sensitive issue. The giant designs its products with soldered or glued components, which makes repairs complex and difficult, if not impossible by an individual. The consequence is inevitable: the price of repair is so high that it is more profitable to buy a new one than to repair the old one [43, 44].

Apple is indeed one of the most efficient computers. However, they use iPhone as company phones. This can be controversial, as there are more sustainable alternatives. Indeed, we can look at fair-phones. B12 Consulting looked at this alternative, finding it unattractive. However, although the fair-phone offers a slightly lower performance in terms of quality, it is difficult to compare the two GPUs because of the differences in platform and optimization. However, these phones do offer some significant advantages. With an ESG score of 98% compared to 86% for the iPhone, the Fair-phone has the advantage of being more durable, more repairable and WEEE neutral. In addition, the cost of these durable phones is lower than that of iPhone [45, 46, 47, 48].

In terms of good practice, some points are to strengthen such as the reuse of machines within the company or, when deemed too old, their recycling for charity. Although it is difficult in IT to properly optimize its electronic devices in order to make the transition to a greener digital world, we believe that greater efforts can be made by the company, although they are blocked by certain obstacles such as technological advances in sustainability.

	++	+	-	--
<b>Reconditioning</b>				x
<b>Eco-friendly machines</b>		x		
<b>Lifetime</b>		x		
<b>Eco-circularity</b>	x			

Table 3.1: Summary of the hardware aspect at B12 Consulting.

One can find in Table [3.1](#) the key points for the hardware and their respective score for the company B12 Consulting. The eco-circularity within the company is well highlighted, their thinking in terms of device lifespan coupled with performance is good, despite the fact that they could make efforts on business phones (whether fair-phone or refurbished) which do not require maximum performance.

### 3.1.1.2 Software aspects

In general, B12 Consulting uses Amazon and Microsoft Azure hosting providers to store their data. Their criterion of choice is the economic cost. Indeed, even if closer data centers exist, they are relatively more expensive and are therefore not interesting for B12 Consulting. As far as projects are concerned, it is their clients who decide on the hosting provider, and it is these same clients who pay. The company has no say in the matter and cannot guide the client to a more local hosting provider.

Their website and services are not designed to be eco-friendly. If they are, it is certainly not on purpose. They think about efficiency rather than environmental impact and that an eco-designed website is certainly less attractive. They think more about quality assurance of their service and profitability than about the environment.

B12 Consulting uses cost as the criterion for choosing hosting providers. Therefore, they do not attach importance to the location in the world. This also acts as a constraint at times when, for example, they develop a service for the medical field. Indeed, the legislation imposes that data relating to health cannot be located outside Belgian territory. B12 Consulting therefore uses digital resources in countries where the energy sector, which is in great demand for data centers, may be less environmentally friendly than in Belgium. One example is China, where prices are much more attractive than in Belgium, even though the country still relies mainly on coal-fired power stations. In addition, a look was taken at the environmental steps that AWS and Microsoft Azure are taking. As far as AWS is concerned, they talk a lot about

green projects for the years to come with quite distant horizons (i.e. 2050) but do not have any concrete data at the moment. There is a lack of clear transparency on their PUE and green indicators. Microsoft Azure has more transparency. One can see a PUE varying (depending on the region) from 1.17 to 1.405 and other indicators on their eco-friendly approaches. There is already much more transparency than with AWS [49, 50].

Finally, the founder of B12 Consulting states that he prefers an interactive and attractive site to an eco-designed one. However, these adjectives can be combined very well. It should be noted that each page viewed on a website generates 4.61 grams of CO<sub>2</sub>. Eco-design therefore makes it possible to make these pages less energy-consuming while maintaining their performance. However, these preconceived notions of reduced performance and attractiveness are false. In fact, in addition to having a lower impact on the environment, an eco-designed site not only saves money, but also focuses on the user’s needs, has a better conversion rate and better referencing and accessibility. An analysis of their website was conducted using the GreenIT Analysis tool. This tool allows to analyze the good practices of the website and to calculate its EcoIndex.

One can find in Table 3.2 the main scores of the B12 Consulting website. One can also find in Appendix A.1 the good practices implemented or not on the website of the company [51, 52, 53].

<b>EcoIndex</b>	<b>Water</b> [cL]	<b>GHG</b> [kgCO <sub>2</sub> eq.]
27.61 (E)	3.67	2.45

Table 3.2: GreenIT Analysis of the B12 Consulting’s web site.

Table 3.2 clearly shows that an improvement of the website is easily possible. Indeed, with an EcoIndex of 27.61 out of 100 (equivalent to an E), this website can be classified as a site with a very low environmental performance. The page is therefore too heavy (4,444 MB), too complex (1072 elements) and contains too many queries (144 queries). All points are therefore to be improved. In Figure 3.1 one can see the median and the target for each criteria to have an eco-friendly site [42].

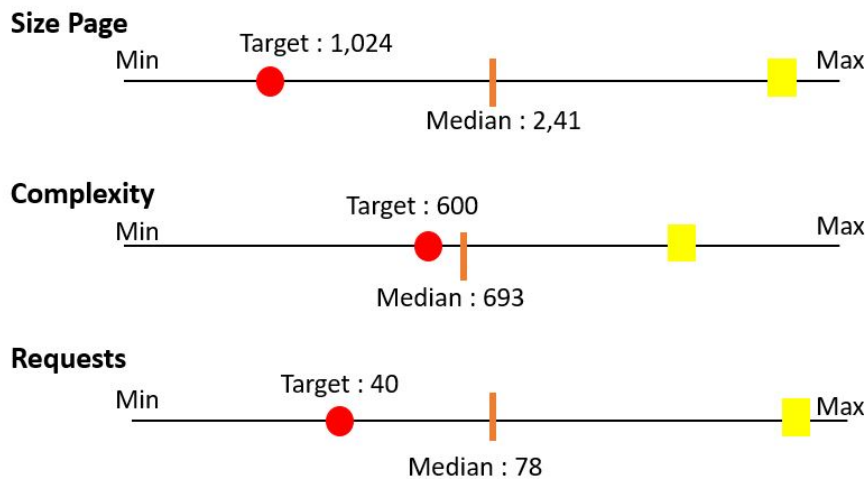


Figure 3.1: Criteria for an eco-designed site where the yellow square represents the B12 Consulting’s score.

To summarize the software aspect, Table 3.3 shows all the important points to be addressed when talking about digital sobriety and their ranking at B12 Consulting.

	++	+	-	--
<b>Data center</b>			x	
<b>Website eco-friendly</b>				x
<b>Good practices</b>			x	

Table 3.3: Summary of the software aspect at B12 Consulting.

### 3.1.1.3 Human aspects

They have no policy or guidelines on environmental responsibility. They practice some eco-gestures like turning off all the lights at a certain time or having built their building so that they don’t have air-conditioning. But there are no major practices in place. One of the only gestures is the teleworking policy. Indeed, although teleworking is allowed up to a maximum of once a week, they agree that the teleworking day should not contain a lot of remote meetings or video conferences, which can actually be worse for the environment than driving to work.

However, the company is trying to raise the awareness of their employees as much as they can. Michel Herquet says that young people feel more concerned about the environment than older people, but that they are not sufficiently aware. This is

where the biggest problem lies: the awareness of individuals. Indeed, as he explains, using a greener search engine is a good thing, but watching videos on social networks such as TikTok is much more environmentally unfriendly than using Google or not deleting thousands of emails.

Having a policy on digital sobriety extends to having a CSR (corporate social responsibility) policy that is part of a sustainable development approach. A company with only about 50 employees is not obliged to have such a clear and precise policy. However, even if the company is far from reaching 500 employees, its goal is still to grow significantly (in recent years, there has been an increase of 15% per year in employees and turnover). A long-term approach and thinking could therefore be put in place for several reasons. The first is that the environment is becoming more and more important to many people. Having a clear policy in the open can raise the profile of the company and recruit young talent who care about the company's environmental impact. This would therefore enhance their image and strengthen their competitive advantage. Secondly, such long-term thinking can only be beneficial for the future, given the increasingly strict rules. Implementing such a strategy from the very beginning of the company will ensure that a routine is in place as the company grows [54].

As seen in the analysis of the hardware aspect of the company, they do not necessarily use refurbished products and do not make any particular effort on their hardware. However, other efforts can be made. For example, watching videos in low definition, unplugging electronic devices when not needed, printing with dark grey ink and not black, printing on both sides, avoiding emails with large files and favour internet links. It is also possible to hold workshops on digital technology to raise the awareness of employees. However, the effort for teleworking is noteworthy. However, care must be taken. Telework does not only have environmental benefits. Working from home leads to alternative commuting, an increase of about 10% in energy consumption in the home, or even air pollution [55, 56].

However, the effort for teleworking is noteworthy. However, care must be taken. Telework does not only have environmental benefits. Working from home leads to alternative travel, an increase of about 10% in energy consumption in the home and digital pollution. Awareness raising was also at the heart of our speaker's remarks. It is clear that a greater awareness of both environmental change and our impact

on the environment is needed. Day-to-day actions are still too often a matter of individual goodwill, without a common vision being put in place through policies. On the business side, it is often the small and medium-sized enterprises that make the most effort. This is partly due to the fact that they have established an ecological model from the start. For a company to rethink its CSR policy, it has to start from scratch, forget everything it has done so far and rethink everything [57].

	++	+	-	--
<b>Good practices</b>			x	
<b>Tele working</b>	x			
<b>RSE policies</b>			x	
<b>Employee awareness</b>		x		

Table 3.4: Summary of the human aspect at B12 Consulting.

In Table 3.4, one can find the different important points concerning the human aspect. A very good point concerns teleworking, but further efforts could be made as mentioned above. If they want long-term growth, they should think about integrating long-term CSR.

## 3.1.2 Belgian Institute for Sustainable IT analysis

### 3.1.2.1 Hardware aspects

The Belgian Institute for Sustainable IT is therefore a non-profit organisation that aims to help other companies in their transition to a greener digital world.

When choosing their hardware, they always try to do the best they can. The ASBL preaches many practices that the employees apply by themselves because they have the same vision even if they don't have a strict purchase policy. So they all have a refurbished computer which they use both in the office and as a private computer. Moreover, they leave it with the organisation if they leave the institute, for the next person to use. So there is a circularity within the company and a reflection when buying a machine. Indeed, they will look at labelled equipment (which respects certain environmental and social criteria), with a long life span and good reparability. They will put this into practice, and will also give this advice to their customers by explaining where the impact comes from and how to reduce it. One of the obstacles to these good practices is the politics behind them and a tax system that does not promote an infinite lifespan.

One can see that this organisation makes every effort to keep their equipment as long as possible, but also to choose equipment that is labelled and environmentally friendly. As he points out, the system does not promote this longer life. In the current system, machine obsolescence is governing due to several problems [58] :

1. *Wirth's law*: software tends to slow down faster than hardware does. This implies that machines become obsolete too quickly for current software. Yet the machine itself works perfectly. So there is a real race between hardware and software [59].
2. *Problem between innovation and progress*: innovation will create obsolescence of machines and therefore also of business. However, there is no longer any real progress. There is no longer any real reflection in digital technology, there are only additive technologies that are not essential for our machines and systems to function correctly [60].

In Table 3.5, one can see that every main criteria for a sustainable hardware is pretty good. They make a lot of effort and follow the advice they give to their clients.

	++	+	-	--
<b>Reconditionning</b>	x			
<b>Eco-friendly machines</b>		x		
<b>Lifetime</b>	x			
<b>Eco-circularity</b>	x			

Table 3.5: Summary of the hardware aspect at Belgian Institute for Sustainable IT.

### 3.1.2.2 Software aspects

On the software side, they offer many services with a charter for their customers, which they also apply to themselves. They will therefore apply good practices in digital accessibility, reducing the impact of file transfers, etc. For example, in their emails, they only use hyperlinks. Or they will use tools like **WeTransfer** so that the emails do not replicate the data. Also, they watch their video in low quality but if it's feasible, they read articles instead.

As far as the data center is concerned, they are with OVH. There is a European charter, a voluntary code of conduct, to commit to being transparent about its energy consumption and its PUE. For their website, they also implement good practices such as not putting videos on their website.

As far as good software practices are concerned, the employees are once again well educated. They implement a lot of eco-gestures that may make a difference. OVH is indeed transparent about their environmental impact via the existing European charter. They publish numerous reports on their ecological approaches and the main environmental indicators of OVH are the following [61] :

- *PUE*: 1.28. knowing that the more efficient it is, the more the result tends towards 1.
- *REF (renewable energy factor)*: 77% which the fraction of the energy used in the data center is renewable.
- *Ratio of reused components*: 25%.

One can notice the transparency of OVH and its indicators rather in accordance with the digital ecology.

An analysis of their website was conducted using the GreenIT Analysis tool. One can find in Table 3.6 the main scores of the ISIT Belgium website. One can also find in Appendix A.2 the good practices implemented or not on the website of the organization.

EcoIndex	Water [cL]	GHG [kgCO <sub>2</sub> eq.]
77.75 (B)	2.17	1.45

Table 3.6: GreenIT Analysis of the ISIT Belgium’s web site.

Table 3.6 clearly shows that lots of efforts are done. Indeed, with an EcoIndex of 77.75 out of 100 (equivalent to an B), this website can be classified as a site with a relative good environmental performance. The page is therefore a little bit too heavy (1.46 MB), simple (528 elements) and contains a good number of queries (43 queries). All points are therefore to be improved. In Figure 3.2, one can see the median and the target for each criteria to have an eco-friendly site.

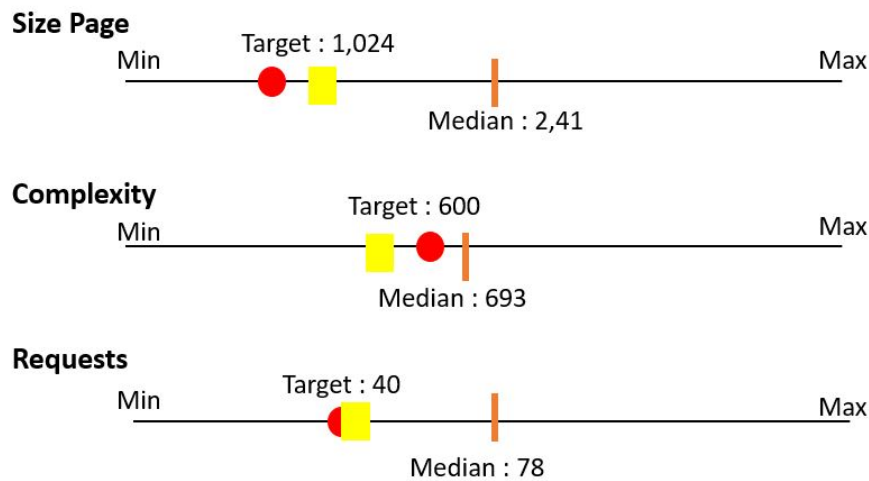


Figure 3.2: Criteria for an eco-designed site where the yellow square represents the ISIT Belgium’s score.

To summarize the software aspect, Table 3.7 shows all the important points to be addressed when talking about digital sobriety and their ranking at ISIT Belgium.

	++	+	-	--
<b>Data center</b>		x		
<b>Website eco-friendly</b>		x		
<b>Good practices</b>	x			

Table 3.7: Summary of the software aspect at ISIT Belgium.

### 3.1.2.3 Human aspects

The non-profit organization has only four employees, so they do not have written guidelines for hardware or good practice. However, they do follow a software charter. Working within this organization, it is clear that the four employees employ good practices and preach eco-actions. For their customers, when they come to them for help, they will tell them to first get trained, to know the orders of magnitude. When they start to spread these good practices at work, the employees, who are individuals, will reproduce these gestures at home in their daily lives.

For the human aspect and therefore the aspect of the actions to be implemented, ISIT Belgium is rather well trained (because this is also its role). They respect and know a large number of daily gestures to put in place to reduce their impact. Nevertheless, everything remains to be qualified. Indeed, a company of four people that reduces the size of its emails and prints in dark grey and not in black, will not have a large-scale impact. However, if a company has 500 or 1000 employees, their impact will be significantly positive. The same observation can be made (and has already been made in Section 3.1.1.3) about teleworking. It is all a question of order of magnitude and nuance.

	++	+	-	--
Good practices	x			
Tele working	x			
RSE policies		x		
Employee awareness	x			

Table 3.8: Summary of the human aspect at ISIT Belgium.

Table 3.8 summarizes the various important points concerning the human aspect and the good practices to be put in place. It is therefore clear that this organization is aware of the subject of digital sobriety and is doing everything possible to limit its environmental impact.

### 3.1.3 UCLouvain en transition analysis

#### 3.1.3.1 Hardware aspects

The hardware aspect will be the most important field of action at UCLouvain. Indeed, based on a study of the ADEME, they realized that approximately 80% of the carbon footprint of the digital industry comes from the production of electronic devices. [?]This is why one of the two main objectives in terms of improvement will be to maximize the life span of the devices used. They have a policy of renewing computer equipment every 5 years. This duration without renewal is already far ahead of private companies where the current trend is 3 years.

The main constraint for renewal is that the university is functional. Indeed, UCLouvain has thousands of machines on its different sites, requiring various levels of performance. In fact, the computers of the computer services or faculty are more demanding in terms of performance and can deviate from the rule if necessary. However, the standard is 5 years, but the Transition plan would like to move towards a non-mandatory renewal if the priority that the system works is met.

After the 5-year period, the equipment has four possibilities:

- It can be bought back by its user at a very low price.
- It can be downgraded to a low resource function such as administration.
- It can be retrieved by doctoral students whose fellowship contract does not include obtaining computer equipment.
- It can enter into a social action of the support network for students in precarious situations. UCLouvain calls upon an external company to refurbish the device and offer it to students in need.

As for the suppliers from which the material comes, there are no defined criteria. Their procedure is to advertise on public markets. They would like to progressively impose reparability criteria to fight programmed obsolescence. To another extent, buying from a supplier who is transparent and correct in the working conditions imposed on the workers is a social challenge but the effort is still light at the moment.

	++	+	-	--
<b>Reconditionning</b>	x			
<b>Eco-friendly machines</b>		x		
<b>Lifetime</b>	x			
<b>Eco-circularity</b>	x			

Table 3.9: Summary of the hardware aspect at UCLouvain en Transition.

### 3.1.3.2 Software aspects

If the production of the devices corresponds to approximately 80% of the carbon footprint of the digital world, we assimilate more or less 20% to the use. In this 20%, the majority is attributed to videos (downloads, videoconferences, etc.). This is therefore the second major focus of UCLouvain, which, with the eco-design/use approach of the hardware, would tackle almost 90% of the total footprint according to Marc Servais.

To do this, the main objectives are to reduce the resolution of the video media when it is not necessary. Indeed, UCLouvain produces many videos for educational or communicative purposes. This trend has been further intensified during the COVID-19 crisis. Marc Servais gave the example of a video of a course that does not need to be in high definition. Yet, simply lowering the resolution of a video from 1080p to 480p reduces data usage by 80% as it is scanned vertically and horizontally, a quadratic increase.

In another register, UCLouvain has an almost complete affiliation with Microsoft for both hosting and software licenses. There is a desire to cultivate the open-source mentality and by extension the concept of "Open Science" as demonstrated by the university in transition section of the UCLouvain website [\[62\]](#).

Concerning data storage, UCLouvain wants to store its data in Europe, not for energy reasons, but to respect the GDPR (General Data Protection Regulation). It has 2 data centers on the UCLouvain site and the Microsoft Cloud with which it had to negotiate to have them in Europe. They are trying to find innovative initiatives, such as building a data center under a swimming pool to optimize the cooling flow by exchanging heat. Although this one fell through, there is ongoing thinking on the issue of data storage.

An analysis of their website was conducted using the GreenIT Analysis tool as introduced in previous sections. One can find in Table 3.10 the main scores of the UCLouvain website. One can also find in Appendix A.3 the good practices implemented or not on the website of the organization.

EcoIndex	Water [cL]	GHG [kgCO <sub>2</sub> eq.]
26.76 (E)	3.70	2.46

Table 3.10: GreenIT Analysis of the UCLouvain’s web site.

Table 3.10 clearly shows that not much effort is being made. Indeed, with an EcoIndex of 26.76 out of 100 (equivalent to an E), this website can be classified as a site with a relative bad environmental performance. The page is therefore too heavy (2.521 MB), too complex (1159 elements) and contains too much queries (90 queries). All points are therefore to be improved. In Figure 3.3 one can see the median and the target for each criteria to have an eco-friendly site.

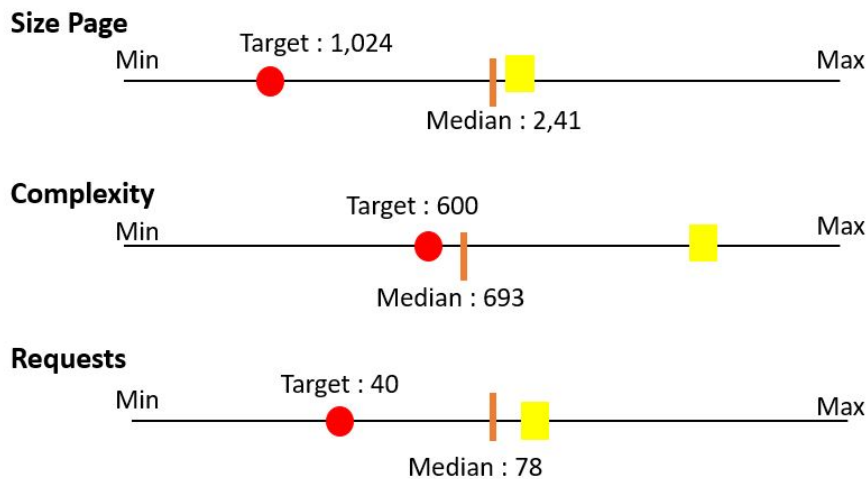


Figure 3.3: Criteria for an eco-designed site where the yellow square represents the UCLouvain’s score.

	++	+	-	--
<b>Data center</b>	x			
<b>Website eco-friendly</b>				x
<b>Good practices</b>		x		

Table 3.11: Summary of the software aspect at UCLouvain en Transition

### 3.1.3.3 Human aspects

Communication among stakeholders in the Transition plan is a challenge. Indeed, the stakeholder structure is somewhat complex. In addition to the forty or so direct employees, it is necessary to ensure that the initiatives are communicated throughout the organization and to find "driving forces" to implement them. However, there are no employees whose sole mission is the implementation of the SDGs.

Fortunately, UCLouvain can count on the presence of very competent academic staff for the different components of the Transition plan. Although they are often busy with their other activities (research, teaching, etc.), motivation often takes precedence over the lack of time to offer. We can mention professors David Bol and Jean-Pierre Raskin for the digital component.

As far as communication is concerned, it differs from internal and external. On the one hand, internally, staff and students are considered sufficiently aware. Investing effectively in this is complicated because we are overwhelmed with information. Nevertheless, a generic MOOC, sent to all staff, was created at the launch of the project to warn of its creation and to raise awareness of UCLouvain's concerns for sustainable development. There is no real campaign from the Transition Plan team. But this does not prevent it from supporting individual initiatives, such as a researcher who started a delocalized action to promote the Ecosia search engine.

On the other hand, external communication is mainly done on the Transition plan section of the UCLouvain website. The detailed plan, progress reports and the objectives as they are currently defined can be found there [\[63\]](#). According to Marc Servais, its visibility is growing, in particular through participation in a world ranking for the improvement of sustainability within universities. For the digital sector specifically, we can find a guide of good practices written with experts in the field (including an affiliation with the Belgian Institute for a Sustainable IT). On the other hand, not being the most important field of action in the Transition Plan, the digital component does not have well-defined long-term objectives, where they aim at carbon neutrality for buildings in 2035.

As mobility is the main impact on the carbon footprint of UCLouvain, the concept of teleworking has been strongly studied. This was foreseen in the mobility part of the

Transition plan already before the COVID-19 crisis with a will to generalize it where possible. Studies such as those of the ADEME have been taken into account on the positive impacts of telework against the potential negative ones (for example the rebound effect on heating). Nevertheless, the policy is 2 days per week in agreement with one's direct supervisor as in most organizations, although there are negotiations with the unions to move to more.

	++	+	-	--
<b>Good practices</b>		x		
<b>Tele working</b>		x		
<b>RSE policies</b>		x		
<b>Employee awareness</b>		x		

Table 3.12: Summary of the human aspect at UCLouvain en Transition.

## **3.2 Comparison**

The purpose of this section is to compare the responses of our three speakers. Each comes from a different environment, namely a company (B12 Consulting), a non-profit organisation (Belgian Institute for Sustainable IT) and a university (UCLouvain). The aim of this section is therefore to highlight the similarities and differences between their respective discourses, but also to see whether their discourse fits their practices within the organisation.

### **3.2.1 Hardware aspects**

B12 Consulting is less exemplary than ISIT or UCLouvain. This is due to the fact that it is a profit-making company and its core business is based on resource-intensive functions such as artificial intelligence and deep learning. This is why their main selection criterion will be performance, regardless of the supplier. They do implement some circularity to extend the life of their devices, but it's not as developed as in the other two organizations.

### **3.2.2 Software aspects**

All three organizations are aware that the main carbon contribution from use is video. They therefore try to make intelligent use of it, reducing quality where possible, or even avoiding it altogether.

Only ISIT implements a multitude of best practices linked to the minimization of data used, as this requires a great deal of effort for a small contribution and involves services that they offer themselves.

When it comes to relocating hosting providers or data centers, B12 Consulting is looking for the most attractive price/performance ratio, except under constraint, while the others have other motivations. In fact, ISIT wants to be as exemplary as possible, otherwise they would lose credibility with their customers. UCLouvain, meanwhile, locates its data in Europe and, if possible, in Belgium, in order to comply with the GDPR.

As far as the websites of the 3 organisations are concerned, the comparison is quite clear. The only organisation that really pays attention (and is aware of all the

possible ways to do so) is ISIT Belgium. The other two organisations do not pay attention to their websites and do not aim to design them in an eco-friendly way. However, there are many things that can be done to reduce :

- *The weight of the page* : optimise images and reduce their size, avoid videos...
- *The complexity* : get to the point
- *The number of queries* : use standard fonts, make static pages...

For comparison, the footprint of each page per 1000 visits per month to the site is shown in Table [3.13](#).

	<b>B12 Consulting</b>	<b>ISIT Belgium</b>	<b>UCLouvain</b>
<b>Water [L]</b>	38.4	26.7	36
<b>GHG emissions [kgCO2e]</b>	2.56	1.78	2.4

Table 3.13: Comparison of the ecological footprint of different websites.

### 3.2.3 Human aspects

Each of the three organizations does not have a formal CSR policy, due to the size of their workforce. Nevertheless, they advocate oral/human transmission of good practice, except in the case of UCLouvain, which has created a good practice guide as well as a MOOC for staff. Indeed, both have a natural trust in their staff when it comes to their level of awareness of sustainable development and CSR. Teleworking is also encouraged, as its carbon impact is of course favorable.

## 4. CONCLUSION

The concern for sustainable development issues has never been so prominent, and the trend is certainly set to increase in the future, particularly with the implementation of the SDGs. Green computing or digital sobriety is a catalyst for sustainability in the ICT sector. It offers a range of tools and best practices in many areas, including hardware, software and people. Nevertheless, there are no incentives or written, institutionalized laws making the implementation of digital sobriety a self-evident reality. In this end-of-study work, a qualitative investigation of various Belgian organizations was carried out to find out how digital sobriety is being implemented in Belgium.

At first, interviews were conducted with three Belgian organizations; namely, B12 Consulting an IT consultancy SME, Belgian Institute for Sustainable IT a non-profit organization, and UCLouvain an academic institution. These interviews were prepared in a semi-directive interview format. Next, the analysis was segmented so as to consider each organization independently, distinguishing three aspects: hardware, software and people. Finally, a comparison between the organizations was proposed.

These interviews enabled a better understanding of the issues, the levers and the existing obstacles to implementing greater sobriety within companies. There are not many policies in place to address the sustainability of digital technology. As a result, companies are thinking first and foremost about the costs that such measures can bring. The technological alternative is also a brake on this sobriety. Raising the awareness of all stakeholders is certainly a major step towards digital sobriety in order to reduce the impact on the environment. Often, a clear policy is never put in place in such small companies. It is only when they have a certain number of employees that real guidelines need to be thought through. If, in the long term, the company's aim is to increase its number of employees, then it can be beneficial to think about this from the outset so that these good actions become habits.

To take this work a step further, there are a number of possible improvements. Firstly, interviews in a larger geographical area (such as Flanders, for example) or with other types of organisation, such as commercial companies, could be envisaged. Secondly, given that raising people's awareness is a key element in achieving digital sobriety, a survey of the population could be envisaged in order to see where people are in their more sustainable thinking, and their knowledge of the impact of digital technology. Lastly, the interviews organised could no longer be in the form of semi-directive interviews, but really in the form of questions without the possibility of rambling. Indeed, even if the semi-structured interviews provide a large number of interesting answers, the interviewees tend to ramble and leave the context of the initial question.

In conclusion, all aspects of good practices in the transition to digital sobriety can be improved. The rapid emergence of new technologies and ever more powerful software is putting obstacles in the way. However, every company needs to be aware of the impact that digital technology is having, and put in place a strategy to counter these phenomena. Clearly, these strategies need to be studied and thought through on a case-by-case basis. Furthermore, even if the companies interviewed are not always the most sensitive to digital sobriety, they are acting on other action plans that affect other SDGs. It would therefore be unfair to summarise a company solely in terms of good digital practices. All the SDGs need to be taken into account, and each of them is implementing, as best it can, actions to achieve its sustainable objectives based on a few SDGs. As a result, we are not yet far enough along in achieving the SDGs' objectives to allow us to focus on all the facets of digital. That's why, at the present time, individual awareness and the propagation of good practices are the most important elements in reducing the harmful effects of this digital world.

## Bibliography

- [1] J. Lieberman. Introduction aux enjeux du développement durable. Chapter 6, 2023.
- [2] Humanium. The millennium development goals. <https://www.humanium.org/en/the-millennium-development-goals/>. [Accessed May 24, 2023].
- [3] UN. Sustainable development goals. <https://www.un.org/sustainabledevelopment/>. [Accessed May 24, 2023].
- [4] Raphael Lemaire. Mise en perspective des impacts écologiques du numérique. <https://www.rafael-lemaire.com/2019/11/02/mise-en-perspective-impacts-numerique/>. [Accessed May 2, 2023].
- [5] CCI Indre. Éco-conception ; maîtriser son cycle de vie et aboutir à de réelles Économies. <https://actu.indre.cci.fr/creation-reprise/eco-conception-maitriser-son-cycle-de-vie-et-aboutir-a-de-reelles-economies/>. [Accessed May 16, 2023].
- [6] Statista. L’empreinte carbone de nos activités numériques. <https://fr.statista.com/infographie/27246/empreinte-carbone%25C2%25A0numerique-technologies-par-type-activite-et-appareil/>. [Accessed May 20, 2023].
- [7] EverTeam. La sobriété numérique. <https://www.everteam.com/fr/la-sobriete-numerique/>. [Accessed May 21, 2023].
- [8] D. Bourg and G.L. Rayssac. *Le développement durable, maintenant ou jamais*. Gallimard, 2006.
- [9] United Nations. Report of the world commission on environment and development: Our common future. <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>. [Accessed May 24, 2023].

- [10] UNFCCC. What is the kyoto protocol? [https://unfccc.int/kyoto\\_protocol](https://unfccc.int/kyoto_protocol). [Accessed May 24, 2023].
- [11] United Nations. United nations millennium development goals. <https://www.un.org/millenniumgoals/>. [Accessed May 24, 2023].
- [12] UNFCCC. The paris agreement. <https://unfccc.int/process-and-meetings/the-paris-agreement>. [Accessed May 24, 2023].
- [13] V. Swaen. Découvrir la responsabilité sociétale des entreprises (rse). Chapter 1, 2023.
- [14] IFDD. Objectifs de développement durable (sdgs). <https://www.developpementdurable.be/fr/themes/objectifs-de-developpement-durable-sdgs>. [Accessed May 24, 2023].
- [15] UCLouvain. Sdg barometer 2022. <https://uclouvain.be/en/faculties/lsm/sdg-barometer-2022.html>. [Accessed May 24, 2023].
- [16] B. Knowles. Computing and climate change. Issue 1, 2021.
- [17] The Shift Project. "pour une sobriété numérique" : le nouveau rapport du shift sur l'impact du numérique. <https://theshiftproject.org/article/pour-une-sobriete-numerique-rapport-shift/>. [Accessed April 26, 2023].
- [18] Green IT. "empreinte environnementale du numérique mondial. <https://www.greenit.fr/etude-empreinte-environnementale-du-numerique-mondial/#empreinte>. [Accessed April 26, 2023].
- [19] Carbo Academy. Le green computing, pour un numérique plus sobre. <https://www.hellocarbo.com/blog/reduire/green-computing/>. [Accessed May 1, 2023].
- [20] IBM. What is green computing ? <https://www.ibm.com/cloud/blog/green-computing>. [Accessed May 11, 2023].
- [21] Greenly. What is green computing and what does it imply ? <https://greenly.earth/en-us/blog/company-guide/what-is-green-computing-and-what-does-it-imply>. [Accessed May 11, 2023].

- [22] EcoSystem. Comment ecosystem accompagne les fabricants d'appareils électriques dans l'éco-conception de leurs produits ? <https://www.ecosystem.eco/fr/article/leco-conception-et-la-demarche-decosystem>. [Accessed May 16, 2023].
- [23] Wallonie. Les impacts du numérique sur l'environnement. [https://developpementdurable.wallonie.be/sites/default/files/user\\_uploads/Les%20impacts%20du%20num%C3%A9rique.pdf](https://developpementdurable.wallonie.be/sites/default/files/user_uploads/Les%20impacts%20du%20num%C3%A9rique.pdf). [Accessed May 16, 2023].
- [24] EcoConso. Quelle pollution le numérique entraîne-t-il sur l'environnement ? [https://www.ecoconso.be/fr/content/quelle-pollution-le-numerique-entraîne-t-il-sur-lenvironnement#\\_Toc75460771](https://www.ecoconso.be/fr/content/quelle-pollution-le-numerique-entraîne-t-il-sur-lenvironnement#_Toc75460771). [Accessed May 17, 2023].
- [25] Chantal de Moerloose (Pr. UCLouvain). Le marketing stratégique et opérationnel. *Dunod*, 2021.
- [26] Anthesis. Mise en œuvre de la réparabilité pour les fabricants d'électronique. <https://www.anthesisgroup.com/fr/reparabilite-pour-les-fabricants-delectronique/>. [Accessed May 18, 2023].
- [27] EcoConso. Bientôt un indice de réparabilité belge. <https://www.ecoconso.be/fr/content/bientot-un-indice-de-reparabilite-belge>. [Accessed May 18, 2023].
- [28] Modifier son entreprise. 4 raisons d'opter pour du matériel informatique reconditionné pour votre organisation. <https://www.modifier-son-entreprise.com/4-raisons-dopter-pour-du-materiel-informatique-reconditionne-pour-votre-organisa>. [Accessed May 18, 2023].
- [29] e dechet. Le reconditionnement et le réemploi des deee. <https://www.e-dechet.com/deee/reconditionnement-et-reemploi-deee>. [Accessed May 19, 2023].
- [30] Léasétic. Comprendre les différentes formes de reconditionnement : remise à neuf, réparation, réutilisation. <https://www.leasetic.fr/blog/formes-reconditionnement>. [Accessed May 19, 2023].

- [31] GEO. Recyclage des smartphones : en progrès mais peut mieux faire. <https://www.geo.fr/environnement/recyclage-des-smartphones-en-progres-mais-peut-mieux-faire-208611>. [Accessed May 19, 2023].
- [32] Laurent B Karin D Laurent L Benjamin N Francis V Cyrille B, Cédric B. L'écoconception d'un service numérique : des actions pour réduire l'impact environnemental du numérique. *Hal Open Science*, 2022.
- [33] GreenIt. L'open source au service du numérique durable. <https://www.greenit.fr/2021/09/28/lopen-source-au-service-du-numerique-durable/>. [Accessed May 20, 2023].
- [34] HAAS Avocats. L'open data et l'open source au service du numérique responsable. <https://info.haas-avocats.com/droit-digital/open-source-open-data-louverture-au-service-du-numerique-responsable>. [Accessed May 20, 2023].
- [35] Michael Guilloux. Programmation : une étude révèle les langages les plus voraces en énergie. <https://programmation.developpez.com/actu/253829/Programmation-une-etude-revele-les-langages-les-plus-voraces-en-energie-Perl-P>. [Accessed May 20, 2023].
- [36] Data4. Qu'est-ce qu'un datacenter ? <https://www.data4group.com/dictionnaire-du-datacenter/qu-est-ce-qu-un-datacenter/>. [Accessed May 20, 2023].
- [37] Alain Clapaud. Data centers : attention aux labels environnementaux bidons. <https://www.clubic.com/pro/article-733815-1-datacenter-attention-labels-environnementaux-bidons.html>. [Accessed May 20, 2023].
- [38] Greenly. Quelle est l'empreinte carbone d'un data center ? <https://greenly.earth/fr-fr/blog/actualites-ecologie/quelle-est-l-empreinte-carbone-d-un-data-center>. [Accessed May 20, 2023].
- [39] OpenEdition Journals. Vers une éducation à la sobriété numérique. <https://journals.openedition.org/revuehn/2858>. [Accessed May 21, 2023].

- [40] Jules Delcon. La bibliothèque numérique responsable. [https://docs.google.com/spreadsheets/d/1ypj4\\_xY\\_oa0fThjIAV9QTIhDJkEzwqX6HMS0s7PJVAg/edit#gid=1549932955](https://docs.google.com/spreadsheets/d/1ypj4_xY_oa0fThjIAV9QTIhDJkEzwqX6HMS0s7PJVAg/edit#gid=1549932955). [Accessed May 21, 2023].
- [41] Chouette Impact. La sobriété numérique en entreprise. <https://chouette-impact.fr/2023/03/06/la-sobriete-numerique-en-entreprise/>. [Accessed May 21, 2023].
- [42] EcoIndex. Quel est l'impact environnemental de votre site? <https://www.ecoindex.fr/>. [Accessed May 23, 2023].
- [43] L'empreinte carbone. Quelle est l'empreinte carbone de apple ? <https://lempreintecarbone.fr/empreinte-carbone-apple/>. [Accessed May 22, 2023].
- [44] Greenly. Quelle est l'empreinte carbone d'un iphone ? <https://greenly.earth/fr-fr/blog/actualites-ecologie/quelle-est-l-empreinte-carbone-d-un-iphone>. [Accessed May 22, 2023].
- [45] CSRHUB. Corporate social responsibility (csr) environment, social, governance (esg) metrics. [https://www.csrhub.com/CSR\\_and\\_sustainability\\_information/Fairphone-BV](https://www.csrhub.com/CSR_and_sustainability_information/Fairphone-BV). [Accessed May 22, 2023].
- [46] CSRHUB. Corporate social responsibility (csr) environment, social, governance (esg) metrics. [https://www.csrhub.com/CSR\\_and\\_sustainability\\_information/Apple-Inc](https://www.csrhub.com/CSR_and_sustainability_information/Apple-Inc). [Accessed May 22, 2023].
- [47] PlusMobile. Apple iphone fiche technique. <https://www.plusmobile.fr/fiches-techniques/apple/iphone-12/128gb/>. [Accessed May 22, 2023].
- [48] 01Net. Fairphone 4. <https://www.01net.com/tests/fairphone-4-fiche-technique-65963.html>. [Accessed May 22, 2023].
- [49] Microsoft. How microsoft measures datacenter water and energy use to improve azure cloud sustainability. <https://azure.microsoft.com/en-us/blog/how-microsoft-measures-datacenter-water-and-energy-use-to-improve-azure-cloud-> [Accessed May 23, 2023].
- [50] Amazon. Cloud computing, server utilization, the environment. <https://aws.amazon.com/fr/blogs/aws/>

- 
- [cloud-computing-server-utilization-the-environment/](#). [Accessed May 23, 2023].
- [51] Wallonie Design. Éco-conception : la sobriété numérique passe aussi par le design. <https://walloniedesign.be/dossiers/eco-conception-web/>. [Accessed May 22, 2023].
- [52] UseWeb. Les bonnes pratiques pour éco-concevoir un site web. <https://www.useweb.fr/blog/post/eco-conception-web-bonnes-pratiques/>. [Accessed May 22, 2023].
- [53] Carbone4. Empreinte carbone du cloud : Amazon, microsoft et google ont-ils la tête dans les nuages ? <https://www.carbone4.com/analyse-empreinte-carbone-du-cloud>. [Accessed May 20, 2023].
- [54] Greenly. Politique rse : comment la mettre en place pour son entreprise en 2023 ? <https://greenly.earth/fr-fr/blog/guide-entreprise/politique-rse-entreprise>. [Accessed May 22, 2023].
- [55] Greenly. Politique rse : comment la mettre en place pour son entreprise en 2023 ? <https://greenly.earth/fr-fr/blog/guide-entreprise/politique-rse-entreprise>. [Accessed May 22, 2023].
- [56] Maxime Degras. Le télétravail est-il vraiment si écologique ? <https://www.agence-france-electricite.fr/actualites/impact-ecologique-teletravail/>. [Accessed May 22, 2023].
- [57] Carine Dartiguepeyrou. Où en sommes-nous de notre conscience écologique ? <https://www.cairn.info/revue-vraiment-durable-2013-2-page-15.htm>. [Accessed May 22, 2023].
- [58] Confrontations Europe. L'innovation à l'ère numérique. <https://www.eesc.europa.eu/sites/default/files/resources/docs/qe-06-16-360-fr-n.pdf>. [Accessed May 24, 2023].
- [59] Theastrologypage. Quelle est la loi de wirth ? <https://fr.theastrologypage.com/wirths-law>. [Accessed May 24, 2023].
- [60] The Innovation and Strategy Blog. Nnovation et progrès : Est-ce la même chose ? <https://theinnovationandstrategyblog.com/2014/07/09/>

---

[linnovation-et-le-progres-est-ce-la-meme-chose/](#). [Accessed May 24, 2023].

[61] OVHCloud. Gérer notre impact environnemental à chaque étape. <https://corporate.ovhcloud.com/fr/sustainability/environment/>. [Accessed May 24, 2023].

[62] UCLouvain. Open education open science. <https://uclouvain.be/fr/decouvrir/open-education-open-science.html>. [Accessed May 24, 2023].

[63] UCLouvain. En transition vers une université durable. <https://uclouvain.be/fr/decouvrir/universite-transition>. [Accessed May 24, 2023].

# Appendices

## A GreenIT analyses

### A.1 B12 Consulting

Bonnes pratiques		
Ajouter des expires ou cache-control headers	✖	24 / 98 ressources cachées ....
Compresser les ressources (>= 95%)	✔	99.6% ressources compressées ....
Limiter le nombre de domaines (<6)	✖	15 domaine(s) trouvé(s) ....
Ne pas retailler les images dans le navigateur	✖	22 image(s) retaillée(s) dans le navigateur ....
Externaliser les css et les js	✖	6 inline stylesheet(s) et inline javascript(s)
Eviter les requêtes en erreur	✔	0 erreur(s) HTTP
Limiter le nombre de requêtes HTTP (<27)	✖	173 requête(s) HTTP ....
Ne télécharger pas des images inutilement	✖	4 image(s) téléchargée(s) mais non affichée(s) dans la page ....
Valider le javascript	✔	Javascript validé
Taille maximum des cookies par domaine(<512 Octets)	⚠	Taille maximum = 793 Octets ....
Minifier les css et js	✖	4/24 css or js non minifiés ....
Pas de cookie pour les ressources statiques	✖	76 ressource(s) statiques avec un cookie (Au total 31.4Ko) ....
Eviter les redirections	✖	2 redirection(s) ....
Optimiser les images bitmap	✖	19 image(s) à probablement optimiser, gain minimum estimé: 319 Ko ....
Optimiser les images svg	⚠	1 image(s) à optimiser ....
Ne pas utiliser de plugins	✔	Aucun plugin
Fournir une print css	✖	Pas de print css
N'utilisez pas les boutons standards des réseaux sociaux	✔	Pas de bouton standard de réseau social trouvé
Limiter le nombre de fichiers css (<=10)	✔	Pas plus de 7 fichiers css ....
Privilégier HTTP/2 à HTTP/1	✔	0/173 ressources utilisant HTTP/1
Utiliser des polices de caractères standards	✖	5 police(s) de caractères spécifique(s) ....

Figure A.1: Good practices analyse for B12 Consulting

## A.2 ISIT Belgium

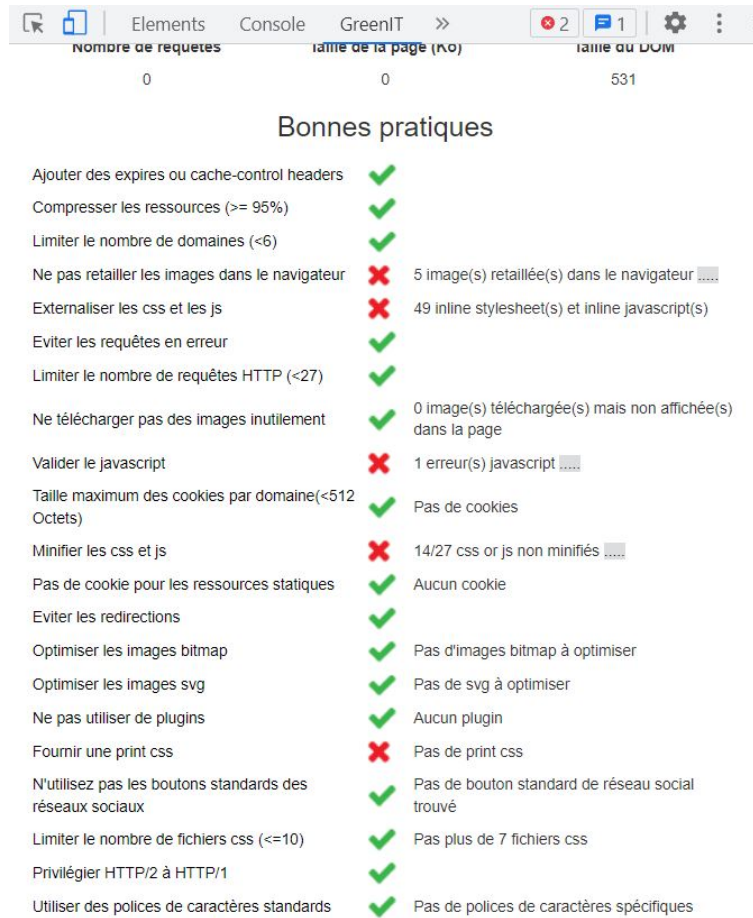


Figure A.2: Good practices analyse for ISIT Belgium

## A.3 UCLouvain



Pratique	Statut	Détails
Ajouter des expires ou cache-control headers	✖	12 / 96 ressources cachées
Compresser les ressources (>= 95%)	✔	96.9% ressources compressées
Limiter le nombre de domaines (<6)	✖	13 domaine(s) trouvé(s)
Ne pas retailler les images dans le navigateur	✖	6 image(s) retaillée(s) dans le navigateur
Externaliser les css et les js	✖	16 inline stylesheet(s) et inline javascript(s)
Eviter les requêtes en erreur	✔	0 erreur(s) HTTP
Limiter le nombre de requêtes HTTP (<27)	✖	102 requête(s) HTTP
Ne télécharger pas des images inutilement	✖	3 image(s) téléchargée(s) mais non affichée(s) dans la page
Valider le javascript	✔	Javascript validé
Taille maximum des cookies par domaine(<512 Octets)	⚠	Taille maximum = 805 Octets
Minifier les css et js	✖	56/80 css or js non minifiés
Pas de cookie pour les ressources statiques	✖	91 ressource(s) statiques avec un cookie (Au total 67.9Ko)
Eviter les redirections	✔	0 redirection(s)
Optimiser les images bitmap	✖	5 image(s) à probablement optimiser, gain minimum estimé: 565 Ko
Optimiser les images svg	✖	1 image(s) à optimiser
Ne pas utiliser de plugins	✔	Aucun plugin
Fournir une print css	✖	Pas de print css
N'utilisez pas les boutons standards des réseaux sociaux	✖	3 bouton(s) standart(s) trouvé(s)
Limiter le nombre de fichiers css (<=10)	✖	26 fichiers css
Privilégier HTTP/2 à HTTP/1	✖	86/102 ressources utilisant HTTP/1
Utiliser des polices de caractères standards	✖	4 police(s) de caractères spécifique(s)

Figure A.3: Good practices analyse for UCLouvain

## B Interview guide

Thank you very much for accepting our request for an interview and for your time. We are two Master's students in Management Sciences at UCLouvain in the Louvain School of Management faculty, who previously graduated as civil engineers in chemistry and biomedical engineering respectively. As part of our end-of-study work, we're carrying out a qualitative study on how Belgian companies/organizations apply management and governance in line with the Sustainable Development Goals (SDGs) at IT level. We've prepared a few questions to help us keep things on track, but we'd be delighted to hear any additional information we haven't thought of. Any information gathered will be used solely for the purposes of our work.

1. Presentation of interviewee and company/organization
2. Setting the context: SDGs and barometer, give some figures on the contribution of digital technology to the climate crisis, outline emerging concepts such as Green IT and digital sobriety.
  - Corporate concerns: economic, ecological, social
  - Internal governance policy and management strategies, projects with a clear IT focus
  - Implementation levers: (non-)government subsidies/grants, ESG score equivalence, energy efficiency, etc.
  - Barriers to implementation: overinvestment, competitiveness, rebound effect, etc.
3. Questions related to physical digital equipment (hardware aspect)
  - Selection criteria: price, environmental score (Energy Star Program, EPEAT tools, etc.), longevity/obsolescence, use (e.g. notebook/laptop/desktop)
  - Usage of tools to estimate energy consumption
  - Life cycle: recycling, reuse, reconditioning
4. Questions related to the use of digital resources (software aspect)
  - Selection criteria of hosting and data center

- Use of open-source/free software, cloud computing, virtualization, AI or other resource optimization techniques
5. Questions related to the proposed services
- Corporate website architecture: energy consumption
  - Efforts in services offered on the market or to the company (software/apps development, etc.)
6. Questions related to the company's internal human efforts (human aspect)
- Implementing "small gestures": appliances switched off, on standby, energy-saving, automated? screen in dark mode, night lighting? eco-friendly search engine? etc.
  - Communication efforts to raise awareness and sensitize staff
  - Use of teleworking or other forms of people management
7. Additional questions, if any, depending on the company/organization



**Abstract :** At a time when the impacts of climate change are becoming increasingly frequent, public awareness is growing. This awareness is partly driven by the SDGs and the CSR policies that have been put in place to contribute to the sustainable development of the planet within our society. However, people are not always aware that this digital world also has an impact on our planet and its environment. Indeed, the digital world currently accounts for 4% of CO2 emissions, and if good practices and more restrictive policies are not put in place, this percentage is likely to increase. The aim of this work is therefore to highlight the consequences and challenges of the use of digital technology in all its forms, within 3 organisations and more generally. This approach has several objectives (1) A better understanding and analysis of IT strategies in the short, medium and long term. (2) A better understanding of the implementation of such a policy within a Belgian organisation. (3) An analysis of the levers and obstacles to this digital sobriety. The interviews revealed the difficulty of implementing a strict policy on an equal footing for all companies in all sectors. For the time being, raising awareness is an important step before a clear digital sobriety policy is put in place in companies, given all the SDGs to be achieved. This work has made it possible to highlight the steps that could be taken to ensure that a policy of digital sobriety is put in place in companies in the years to come, and to gain a better understanding of the issues involved.

**Résumé :** À l'heure où les impacts du changement climatique se font de plus en plus fréquents, la prise de conscience du public s'accroît. Cette prise de conscience est en partie motivée par les ODD et les politiques de RSE qui ont été mises en place pour contribuer au développement durable de la planète au sein de notre société. Cependant, les gens ne sont pas toujours conscients que ce monde numérique a également un impact sur notre planète et son environnement. En effet, ce monde numérique représente actuellement 4 % des émissions de CO2, et si de bonnes pratiques et des politiques plus restrictives ne sont pas mises en place, ce pourcentage risque d'augmenter. L'objectif de ce travail est donc de mettre en évidence les conséquences et les enjeux de l'utilisation du numérique sous toutes ses formes, au sein de 3 organisations et de manière plus générale. Cette approche a plusieurs objectifs (1) Une meilleure compréhension et analyse des stratégies informatiques à court, moyen et long terme. (2) Une meilleure compréhension de la mise en œuvre d'une telle politique au sein d'une organisation belge. (3) Une analyse des leviers et des obstacles à cette sobriété numérique. Les entretiens ont montré la difficulté d'une politique stricte et au même pied d'égalité pour toutes les entreprises, tous secteurs confondus. Pour le moment, la conscientisation est une étape importante avant une mise en place claire d'une politique de sobriété numérique dans les entreprises, au vu des tous les SDGs à atteindre. Ce travail a permis de mettre en évidence les démarches envisageables à fournir afin qu'une telle politique de sobriété numérique soit mise en place dans les entreprises dans les années à venir, et de comprendre mieux les enjeux liés à celle-ci.

**UNIVERSITÉ CATHOLIQUE DE LOUVAIN**  
Louvain School of Management

Place des Doyens, 1 bte L2.01.01, 1348 Louvain-la-Neuve  
Boulevard Emile Devreux 6, 6000 Charleroi, Belgique  
Chaussée de Binche 151, 7000 Mons, Belgique

[www.uclouvain.be/lsm](http://www.uclouvain.be/lsm)