



HAL
open science

Digital sobriety: From awareness of the negative impacts of IT usages to degrowth technology at work

Céline Péréa, Jessica Gérard, Julien de Benedittis

► To cite this version:

Céline Péréa, Jessica Gérard, Julien de Benedittis. Digital sobriety: From awareness of the negative impacts of IT usages to degrowth technology at work. *Technological Forecasting and Social Change*, 2023, 194, pp.122670. 10.1016/j.techfore.2023.122670 . emse-04116949

HAL Id: emse-04116949

<https://hal-emse.ccsd.cnrs.fr/emse-04116949>

Submitted on 23 Jun 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

Please cite as : Céline Péréa, Jessica Gérard, Julien de Benedittis, Digital sobriety: From awareness of the negative impacts of IT usages to degrowth technology at work, Technological Forecasting and Social Change, Volume 194, 2023, 122670, ISSN 0040-1625, DOI [10.1016/j.techfore.2023.122670](https://doi.org/10.1016/j.techfore.2023.122670).

Digital sobriety: from awareness of the negative impacts of IT usages to degrowth technology at work

Céline Péréa, Jessica Gérard, Julien de Benedittis

Abstract

The rise of digital technologies has led to growing concern over their environmental impact, prompting the emergence of the phenomenon of digital sobriety. Rooted in the principles of degrowth technology, digital sobriety advocates for reduced technology usage to create a more sustainable society. However, it contrasts with typical frameworks that promote the continued use of IT. Furthermore, it runs counter to the prevailing trend of digital transformation within organisations, which is expected to expand in the future. As a result, it challenges conventional approaches to IT usage and the associated contextual factors. The purpose of this paper is to investigate the concept of digital sobriety, examining its relationship to conventional approaches as well as the degrowth technology perspective. The study explores how digital sobriety is implemented within organisations and how it is perceived by IT users. Thirty-three participants from IT companies were included and the scope and characteristics of the phenomenon of digital sobriety were identified, including five levels of IT user maturity: refutation, inaction, substitution, optimisation, and disadoption/degrowth. The results highlight the need to balance the internal and external factors of digital sobriety and identify different trajectories of digital sobriety as socio-technical imaginaries for the future of IT.

Keywords: Digital carbon footprint, Digital sobriety, Degrowth technology, IT uses, Green IT, Sociotechnical imaginaries

This research did not receive any specific grant from funding agencies in the public, commercial, or notfor-profit sectors.

1. Introduction

Digital twins, 3D-printing, Machine Learning and Artificial Intelligence (AI), Big data analytics, Internet of Things (IoT), Blockchain technologies, visualisation technologies, simulation and modelling, and so forth – all of these enhanced information technologies (IT) (Culot *et al.*, 2020) are dedicated to improving the way organisations operate and manage their business to create more economic and social value (He *et al.*, 2022). Through their study of discontinuance and low carbon digital products and services, Vrain *et al.* (2022) provide a first step toward understanding how this frenetic digitalisation can be thought of differently in order to be compatible with current environmental concerns.

Indeed, digital carbon footprint is increasingly cited among pollutants, and promises of a better world thanks to IT are largely questioned today (Dorr, 2017; Heikkurinen, 2018; Slaughter, 2018). The exponential demand for energy and resources required for IT is now largely recognised as negative for the environment (IEA, 2021). Awareness of this pollution among IT users is still limited as it is often invisible (Gnanasekaran *et al.*, 2021). The ecological consequences of data storage through cloud computing are mysteriously kept hidden and remain abstract for IT users (Borning *et al.*, 2020). Nevertheless, the direct and indirect effects of IT on the environment are now better known (Berkhout and Hertin, 2004; Horner, 2016) and IT users are increasingly willing to moderate their uses (Gnanasekaran *et al.*, 2021).

In a world of finite resources and climatic disasters, sustainable consumption and reducing impact on climate are promoted by the United Nations (2020). In line with the Sustainable Development Goals, the urgency of reducing IT uses is now being highlighted (Freitag *et al.*, 2021), and uses are starting to be implicated – much like IT production and transportation – as being detrimental to the environment. Consequently, there has been a call to limit IT uses in the future through the digital sobriety of IT users (The Shift Project, 2020), along with an underpinning transition to “degrowth technology” (Kerschner *et al.*, 2018). Related adaptation of IT uses consists of anticipating future scarcities which are in line with socio-technical anticipation (Tomlinson *et al.*, 2013) and accordingly socio-technical imaginaries as considered by the approach of Jasanoff and Kim (2009). This perspective is particularly adapted to technological foresight studies (Hermann *et al.*, 2022). Overall, we can consider digital sobriety as similar to the reduction of water consumption, transportation, and waste. Despite the similarities, reducing the use of tools that are dedicated to employee productivity seems to be rather specific. In

addition, this phenomenon may deviate from traditional research on IT adoption or the adoption of Green IT practices. During the post-adoption phase, the intention of IT users to continue is usually encouraged by managers and studied by researchers. In addition, this commitment to decreasing technological support in organisations is in contradiction with their digital transformation, which largely contributes to a rise in their uses of IT (Itten *et al.*, 2020). Generally, the concept of digital sobriety, understood as a phenomenon of degrowth technology, appears to contradict previous contexts and frameworks that favour the continuance of IT use. Therefore, digital sobriety raises questions about the adequacy of the conventional approach to studying IT adoption, which typically focuses on users' perceptions and the organisational context in which it occurs. At present, it is unclear whether achieving digital sobriety involves conventional practices of adopting Green IT, or if it requires a new contextual approach that involves the discontinuation of IT use and considers new factors. Consequently, the specific challenge of voluntary abandonment or moderate use of IT at work is relatively new and merits exploration.

In this piece of work we primarily question the place of digital sobriety in organisations, asking the following questions: “What is digital sobriety?”, “How is it implemented in organisations?”, and “How is it perceived by IT users in organisations?”

This research aims to identify the dimensions and factors involved in digital sobriety by understanding users' behaviours and the context of its implementation. To achieve this, we first define what digital sobriety is by drawing on the literature relating to IT and degrowth technology. To study the perception of digital sobriety and the context of its implementation in organisations, we then combine the concept of IT discontinuance with the “Technology-Organisation-Environment” (TOE) framework. By using these approaches, we can better understand the various factors that affect the adoption of digital sobriety in organisations and its context of implementation. By doing so, we are able to examine whether traditional factors that influence IT adoption remain effective in the context of degrowth technology. Finally, we make an additional contribution by offering a comprehensive characterisation of digital sobriety, highlighting how it tends to happen progressively, as well as by presenting a typology of user profiles based on their level of digital sobriety maturity. By exploring this phenomenon, the results could provide valuable insights for managerial recommendations that could help companies position themselves effectively in response to this growing movement.

2. Literature review

2.1 Digital sobriety: a dimension of Green IT

2.1.1 From the observation of IT pollution to the need for digital sobriety

Digital carbon footprint is increasingly cited as being among the sources of pollution caused by human activities. The exponential demand for energy and resources for producing and using IT has a negative impact on the environment (IEA, 2021). The entire IT life cycle is responsible for greenhouse gas emissions which continue to grow every year (Freitag *et al.*, 2021). Many end users of IT materials have started to be concerned by this negative impact (Gnanasekaran *et al.*, 2021), and are trying to lower their propensity to buy and use large amounts of digital products (Guillard, 2021). Although many companies have recently declared their intention to reduce their e-pollution, this commitment stands in contradiction with their digital transformation which contributes heavily to increasing their IT uses (Itten *et al.*, 2020). Drawing on the Paris Agreement and the work of the International Telecommunication Union (ITU), Freitag *et al.* (2021) remind us that to limit global warming to a maximum of 1.5°C, the IT sector must decrease its emissions by more than 40 percent by 2030.

Tomlinson *et al.* (2013) describe this decrease in IT uses as a change in our socio-technical system, where the usual social and technical fit is broken, as reducing IT uses does not align with the current remaining abundance of resources, but merely fits with anticipated scarcities and social crisis. The authors name this anticipated adaptation the “informatics collapse”. This socio-technical perspective is in line with the “socio-technical imaginaries” presented by Jasanoff and Kim (2009) as technological trajectories which reflect collective and imagined futures. In this case, the imaginaries are at the opposite pole of scenarios dealing with the positive expectations from technologies (March, 2018) and, more generally, with technological innovation (Konrad and Böhle, 2019). Degrowth technology does not entail abandoning all our technologies, but simply moderating IT uses and IT design by focusing on what is really needed (Heikkurinen, 2018; Slaughter, 2018). In general, degrowth technology is in line with the general trend of a degrowth economy. Degrowth, which is also known as “neo-growth”, consists of favouring the collective and sustainable progress of humanity (Breyer *et al.*, 2017).

Concerning digital sobriety, good practices have already been identified and promoted. For instance, Elgaaïed-Gambier *et al.* (2020: 122) have listed many online sober IT behaviours, such as reducing the size of emails, their frequency, and the number of receivers, as well as limiting attached files, compressing them, and avoiding watching streaming media, etc. In terms of the energy consumption of

IT equipment, the advice is to switch it off when not in use (Murugesan, 2008). More broadly, digital sobriety can be related to the general trend of sobriety which is defined by Guillard (2021: 36) as “a lifestyle that involves not just consuming better but also, and critically, consuming less”. It is also part of the general trend of the “degrowth society” which goes back to essential uses and consumption (Kerschner *et al.*, 2018). Although we can easily understand the need for digital sobriety, the idea still needs a definition. We suggest characterising it through the literature on Green IT.

2.1.2 Digital sobriety as a technological scepticism dimension of Green IT

Murugesan (2008: 25) defines Green IT as “the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems (...) with minimal or no impact on the environment.” Greening IT uses is rarely considered in Green IT definitions. Among the seventeen definitions gathered by Singh and Sahu (2020), only four of them mention IT uses. Moreover, when uses are mentioned, these are Green IT uses, or IT uses for greening the world. For instance, Trimi and Park (2013: 366) highlight the potential of IT uses for preventing “air, water, and soil pollution”. As such, Green IT is usually and largely described as a way of greening the world by using IT (Melville, 2010). In addition, Green IT practices are mainly studied through actions such as shutting down computers (Chugh *et al.*, 2016) and do not involve moderating IT uses.

Decreasing IT use with respect to digital sobriety seems to be a neglected topic. This may be because the Green IT literature merely highlights the potential of IT for greening the world, which is not in line with a perspective that recognises the harmful consequences of IT uses. Consequently, it seems to have two opposing views of approaching the place of IT in our society: IT as a solution for greening the world (Trimis and Park, 2013), and IT being held partly responsible for ecological disasters (Castro *et al.*, 2021; Elgaaied-Gambier *et al.*, 2020). Digital sobriety is clearly in line with the latter perspective. The divide between these remains because it is difficult to disentangle the effects of IT on the environment (Berkhout and Hertin, 2004; Halder and Sethi, 2022; IEA, 2021). Furthermore, the situation is likely more complex because positive and negative effects seem to be intertwined (Berkhout and Hertin, 2004). For instance, the perceived usefulness of using AI for greening the world is mitigated (Leal Filho *et al.*, 2022). However, Lammers *et al.* (2022) empirically show that start-ups whose activities mainly rely on IT and AI continue to favour economic growth over sustainability. In addition, technological innovations such as 5G may increase energy consumption (Cheng *et al.*, 2022).

More generally, these two opposing perspectives of IT's effects allude to the opposition between techno-optimism and techno-scepticism. Asayama and Ishii (2017: 421) describe techno-optimists as “hopeful and confident that their technological innovations are making and will continue to make a

positive social change”. Conversely, techno-sceptics do not believe that human progress and sustainability will stem from technological innovation (Pansera *et al.*, 2019). Previous forecasting studies have already shown the opposition between people’s consciousness in a forthcoming ecological crisis and their technooptimism (Boschetti *et al.*, 2016). Considering the progress of knowledge on the causes of ecological crisis, technological optimism can be seen as “naïve” (Dorr, 2017). Therefore, digital sobriety seems to be a techno-sceptical perspective of Green IT, which aims to reduce IT uses that are excessive and detrimental to the environment. We will now consider the literature dealing with IT users’ perspectives.

2.2 Digital sobriety of users in organisations

2.2.1 Discontinuance of IT uses despite user satisfaction

To the best of our knowledge, reducing IT uses has not yet been studied in the field of IT discontinuance for uses linked to ecological concerns. Instead, authors have studied “IT disconfirmation” (Bhattacharjee and Premkumar, 2004) and “IT discontinuance” (Turel, 2015) whereby users, during the post-adoption phase, are no longer satisfied with the performance of the IT and decide to abandon it. In line with this work, we can define digital sobriety as different levels of discontinuance of uses owing to ecological concerns and despite the satisfaction of users with IT.

Usually, studies focus on factors that favour the continuance of uses and prevent the discontinuance of uses. IT users’ intentions to abandon IT are negatively perceived and defined by Xu *et al.* (2017: 103104) as coming from “disenchanted consumers” who are an illustration of “technology failures”. By studying these disenchanted IT users, Rosen (2005) has empirically shown that performance expectancies, use effort, and social influence partly predict the decline in intention to continue IT use over time. Bhattacharjee and Premkumar (2004) have also studied how changes in IT users’ beliefs and attitudes may lead to IT uses being abandoned. These factors must be studied in the context of digital sobriety. Indeed, it appears that reducing IT uses has not yet been studied in relation to ecological concerns. Studying IT users’ behaviours, Elgaaïed-Gambier *et al.* (2020) reveal that users wait for interventions from the government and IT companies to motivate their actions to reduce IT uses. As such, there is a need to study managerial support for digital sobriety.

2.2.2 Implementing digital sobriety at work

To study the implementation of digital sobriety, we draw on the TOE framework, which is often cited in Green IT adoption studies (Anthony, 2020; Mouakket and Aboelmaged, 2021). This framework was developed by DePietro *et al.* (1990), who consider IT adoption as being at the intersection of three

contextual dimensions: technological, organisational and environmental. These dimensions can be internal and external to organisations and explain the entire process of adoption. Thanks to this framework, previous research has identified many factors which favour the implementation of Green IT in organisations. Technological aspects have been related to IT infrastructures, information management (Anthony, 2020), and, more generally, to technologies available on the market (DePietro *et al.*, 1990). Organisational factors are studied through company strategy, management support, IT practitioners' attitudes (Anthony, 2020), and company size (Bose *et al.*, 2011; Nedbal *et al.*, 2011). Environmental factors can be ecological practices (Anthony, 2020), regulatory support, and competition intensity (Bose *et al.*, 2011; Nedbal *et al.*, 2011).

Previous studies have mainly covered the adoption context of Green IT in general (Mouakket and Aboelmaged, 2021). The factors may not be the same in the field of implementing digital sobriety, which, as we have seen previously, deviates from conventional IT adoption incentives owing to its technological scepticism. Factors that encourage the withdrawal of IT uses may result from another contextual dimension. The Shift Project report (2020: 68) on digital sobriety, encourages limiting IT uses to reduce their environmental impact. Limiting uses can, however, lead to feelings of guilt by users. Nevertheless, in the field of addictive IT, Turel (2015) wonders whether it is moral to play with the feeling of guilt of IT users when targeting their Information Systems (IS) discontinuance intentions. Consequently, this specific context of implementing digital sobriety must be studied to identify its most favourable context.

3. Methodology

3.1 Data collection

To study the implementation of digital sobriety in organisations, we drew on interviews with IT workers. We selected nine French organisations of heterogeneous size (from fewer than ten employees to more than 5,000), which operate in various spheres of the IT industry (networks, telecommunications operators, internet service providers, consulting, software development, etc.), offering services to other companies or the general public. They were selected because they are the most concerned and are organisations with a potentially high level of e-pollution awareness. As such, they were selected using this criterion, which serves the purposes of our study (Morgan, 2008). Data collection was based on 33 semi-structured interviews (see Appendix A). We recorded all interviews using a voice recorder and transcribed them, resulting in 401 pages of raw data. The interviews were conducted between January and July 2021 and lasted between 14 and 75 minutes. The authors used a non-random convenience sampling approach, also known as snowball sampling, to recruit participants. They were contacted

through the authors' address book. Each interview dealt with three main themes related to our three research questions: “What is digital sobriety?”, “How is it implemented in organisations?”, and “How is it perceived by IT users in organisations?” (see Appendix B). Interviewees held different positions within the companies studied, covering a wide range of functions, responsibilities, and decision-making powers (IT, Corporate Social Responsibility (CSR), marketing, etc.). They were simple IT users, decision makers, or both in some instances. In addition, to fully explore the degree to which organisations adopt digital sobriety strategies, we collected data in relation to two scenarios proposed by Miles *et al.* (2013: 36): (1) instances where interviewees effectively advocate an orientation towards more digital sobriety; and (2) “negative” instances where interviewees are in no way sensitive to this cause and have a very critical perspective towards IT degrowth. Data was collected until theoretical saturation was reached (Rowlands *et al.*, 2016: 43).

3.2 Data analysis

After asking the consent of our interviewees, all interviews were recorded, made anonymous and confidential, and transcribed. Several themes were identified within the literature review and integrated into our coding table, which was developed using Saldana’s (2021) instructions on life cycle coding. We applied a simultaneous coding method (Miles *et al.*, 2013: 81) when relevant. This was the case when interviewees pointed to interactions between, on the one hand, a dimension of the TOE framework and, on the other, their individual perception of the topic. This simultaneous coding makes it possible to articulate both the individual and organisational aspects of digital sobriety.

To define digital sobriety and analyse the context of its implementation in organisations we drew on all three dimensions of the TOE framework. The technological dimension helped us characterise digital sobriety by considering the technological context, which is also a critical issue. We then describe how digital sobriety is implemented within organisations and examine the broader environmental factors at play. To study the perception of digital sobriety by IT users, we used adoption model aspects to specify the perceived ease and usefulness of digital sobriety, as well as to evaluate intentions to discontinue use. By adopting these two well-known frameworks related to IT adoption, we tested their adequacy to determine whether digital sobriety can be understood through established approaches or whether novel approaches more aligned with the degrowth technology perspective are necessary. In Appendix B, we present the main themes of our interviews and their corresponding questions.

4. Results and discussion

4.1 Digital sobriety characterisation and its deployment in organisations

4.1.1. Digital sobriety: a polysemous notion

Digital sobriety appears to be a polysemous notion. Several names were used by our interviewees. Some of them talk about “*Green IT*” (I.05), others use “*digital sobriety*” (I.01), or “*sustainable IT*” (I.01), “*responsibility, frugality*” (I.07), “*responsible digital*” (I.03, I.20, I.21), “*dedigitalisation*” (I.09) or “*Sustainable Digital*” (I.05). Despite a variety of terminologies, interviewees describe a similar reality “*digital sobriety means using digital tools but wisely*” (I.01) in order to minimise our negative impact on the environment. “*Digital sobriety in a company context is what can be put in place and what should be done in ecological terms so that the digital footprint of companies is smaller*” (I.18). Overall, our interviewees all have a perception of what digital sobriety is.

Regarding the prospects of this concept of digital sobriety, several scenarios are envisaged by our interlocutors. Some think that the steps taken today make it possible to “*plant a seed somewhere, we plant a seed in people's brains and maybe in a year, two years, three years, I don't know, we will be able to go further*” (I.14). Nevertheless, this seed remains for the moment too “*reserved for a minority, those who are completely focused on the subject, who work on it*” (I.06). Others are much less optimistic and think that “*it will, unfortunately, get worse*” (I.13) because digital technology plunges people into a “*flow, I'm in the same river, which will become a torrent*” (I.13), that it seems hard to stop because “*digital is the future, it's modern, so it's something we can't question*” (I.05). Moreover, reasoning on a planetary scale, one of our interlocutors is even more pessimistic, because: “*when you combine China, India and a fair few African countries which do not yet have good access to 4G, that will hurt. So I don't see a great future for digital sobriety*” (I.04). This predominance of digital must be regulated and this must happen by means of “*rethinking the advertising system, rethinking the economic model*” (I.09). Another solution envisaged lies in acculturation to the phenomenon, from school, “*where we put that in the subjects*” (I.06) taught to children.

4.1.2 Techno-centric logic and digital sobriety: a paradoxical injunction?

For some of our interviewees, digital sobriety is a fundamental issue for companies in the digital sector. Nevertheless, these same people have the feeling “*that there is a great lack of information on the subject,*

and I find that quite paradoxical when we are directly linked to this digital world” (I. 19). In addition, while our interviewees are informed and aware of the environmental consequences of excessive use of digital technologies, a large part of the actions developed to communicate or raise awareness are carried out through digital tools such as Massive Open Online Courses (MOOCs): “And there’s something we’ve just finished, it’s really recent, it’s a module, a MOOC, really online training with several videos about general awareness of digital impacts” (I. 30). Organisations go so far as to develop training which is itself entirely dematerialised: “I’m in the process of creating an awareness module, for online training” (I. 22).

These paradoxes seem to stem from the combination of techno-optimism and techno-scepticism perspectives in organisations, which is similar to the contradiction identified by Itten *et al.* (2020) regarding technological degrowth and the phenomenon of digital transformation, and in line with the complexity of the coexistence of optimism and scepticism noted by Berkhout and Hertin (2004). Indeed, these two perspectives seem to be interrelated in the implementation of digital sobriety. This indicates a potential mismatch between corporate sustainability strategies and corporate competitiveness strategies, which should be aligned if they are to be implemented correctly (Baumgartner and Ebner, 2010). When both strategies are aligned, this indicates the highest maturity level of corporate sustainability (Sari *et al.*, 2020). Nevertheless, it seems difficult for companies in the field of IT to align both. More generally, we can consider that digital sobriety paradoxes are akin to other paradoxical contexts in organisations, such as paradoxes of learning related to choices to be made between exploitation and exploration, and incremental and radical innovation (Smith and Lewis, 2011).

4.1.3 Progressive incentives for implementing digital sobriety in organisations

Our analyses enable us to identify a development process for a digital sobriety approach using three stages: raise awareness, rationalise the procedure of digital sobriety, and frame it into a digital sobriety strategy.

The awareness-raising stage is reflected in several actions implemented in organisations, in particular through communication such as “*a newsletter once a month where we will highlight a CSR aspect linked to digital sobriety*” (I.10). It is about “*making people realise that it’s important. From the moment they become aware, they will inevitably act on their own.*” (I.06).

The second step goes further by involving more stakeholders, but gradually, in order not to pressurise them. Nevertheless, this approach must be “*uniform. (...) So we can do a V1 which is basic, then a V2 that is a little more elaborate, which adds some upper layers. (...) we really have to proceed like that and*

allow people to exchange views". This rationalisation with employees can be done by using "ambassadors", who *"act as an intermediary, an aid, and as a CSR specialist; and, more specifically, someone who offers help with everything to do with us"* (I.10).

Lastly, the third framing stage goes further in the formalisation of the approach. At this point, the company has to establish a real strategy based on concrete actions, such as participation in World Cleanup Day, where *"in this context, I set a challenge, within my project, to get teams to compete on who will do the most cleaning"* (I.22). Here, the use of indicators must make it possible to measure the evolution of this anchoring strategy in the practices of employees so that they can be located via *"the display of indicators (...). Likewise, it takes time to develop reports saying 'you have data'. To tell people 'here's the average storage, it's 1.2 gigs, where do you stand? Where are you compared with the average? Are you above? Are you below?'"* (I.11).

Gradually supporting the readiness for change of IT users is in line with general sustainable maturity models whose socio-technical transition moves through different stages, from "predevelopment" to real "disruption" (Kivimaa *et al.*, 2019: 1068). During this socio-technical transition for sustainability, the need to measure efforts and gains has already been underlined by Turnheim *et al.* (2015). This procedure is generally in line with the work of Aitken *et al.* (2011), who empirically show that when people are informed about climate change and potential action, they are more willing to do something for the environment.

4.1.4 Ubiquitous digital sobriety: internal, external, bottom-up, and top-down influences

Digital sobriety occurs in both directions: top-down and bottom-up. Some employees can be proactive in the process, and management can also respond proactively to meet regulatory constraints (already in place or to come) and stakeholders' expectations (employees, customers, partners, etc.).

For the bottom-up dynamic, digital sobriety is both a proactive and reactive response to the demands that emanate from managers and employees who *"request it, they are increasingly demanding, and they even say, beyond asking on a personal level, that they want to work for a company that addresses this area. So we also have an issue that goes beyond just business: we have an employer brand question"* (I.11). Moreover, from an outside perspective this is *"essential also for recruiting future talent, young people who are increasingly concerned, we talk about it a lot but I think it's true, it's not just talk"* (I.33), because these young people *"will not work for a company that is not committed to the climate"* (I.22). The company must therefore *"show that it is committed and that it's not talking nonsense if it is to attract new recruits"* (I.22) and green its employer brand.

Secondly, the top-down approach relates to incentives for implementing digital sobriety which come from market requirements that customers, shareholders, or competitors could impose. Companies must respond to “*customers [who] are becoming aware of this*” and who “*are asking us more and more what we are doing to reduce the impact of what we are going to do*” (I.30). It therefore seems logical, from the point of view of our interviewees, that digital sobriety could help in maintaining competitiveness because “*it will be the fundamental issue of the next ten years. A company cannot miss this wave, so in order not to be left behind, I think it is essential*” (I.33).

Finally, our interviewees underline the expectations¹ of companies in terms of regulations, which are external sources of influence. For them, it is fundamental that regulations intervene to frame the uses of IT. In the meantime, companies are invited to “*anticipate the regulatory constraints which, I think, will inevitably come*” (I.33) and thus not allow themselves to be surprised and left in a reactive position.

This ubiquitous digital sobriety is in line with the work of March (2018) who specifies the need for a bottom-up strategy to favour degrowth technology through the freeing up of IT users and designers. The author explains that this phenomenon can draw on the open-source philosophy, which is strongly participative and collaborative. Externally, this strategy constitutes an employer brand which is recognised for increasing organisational attractiveness, making it easier to recruit (Collins and Stevens, 2002; Knox and Freeman, 2006). As such, digital sobriety could be seen as novel work practices with a humanitarian and participative perspective. In addition, this ubiquitous process illustrates the complexity of the transition pathways to sustainability, which stem from multiple stakeholders, as described by Turnheim *et al.* (2015).

4.2 Different perceptions and levels of digital sobriety of IT users in organisations

4.2.1 Resistance to digital sobriety

Firstly, we note a resistance to digital sobriety, mainly owing to a lack of awareness and the perceived uselessness of moderating IT uses. People may reject digital sobriety because they are not sensitive to environmental causes, not aware of their digital footprint on the environment, or because they still believe in the human and technological potential to find solutions as mentioned by Interviewee 27: “*the very nature of humanity is to invent new things, so, in fact, we will always find a solution. Technology will save us*”. In addition, several of our interviewees did not seem convinced by the impact of efforts made to reduce their digital footprint. Indeed, many of them report that “*the question of emails does not require, in my opinion, any strong action; because the gain is not exceptional either*” (I.04), or “*it's like saying*

to someone who needs to lose 10 kg, 'remove a grain of rice from your plate'; it's about the same order of magnitude" (I.01). These types of perception are in line with what Kerschner *et al.* (2018) describe as

¹ Data collection was carried out only a few months before the French Parliament passed the *réduire l'empreinte environnementale du numérique* (REEN) Act, which aims to reduce the environmental footprint of digital technologies.

the dominant socio-technical imaginary of our society, arguing for a technological solutionism for all human challenges, something March (2018) describes as the fetishism of technologies. Consequently, the perceived usefulness of digital sobriety seems to be inconsistent with the technological optimism stance.

4.2.2 Aware but powerless

While some are aware of the digital footprint, they remain passive because they consider digital sobriety as a big change; so big that the magnitude of this change inhibits their actions. Indeed, they think that digital sobriety "*is actually an extremely complex subject because we are touching the foundations of our society, so it's not going to happen right away*" (I.33). Moreover, changing habits of IT uses seems to be difficult, or undesirable. For instance, Interviewee 3 notes that: "*there are still people who are reluctant and who are stuck in their habits*". The society of plenty is implicated as limiting efforts and encouraging mass IT uses. According to Interviewee 7, "*in Europe, we are so used to having abundance from a digital point of view that we don't think about using it correctly*". Furthermore, "*it's like putting a glass of wine or a bottle of wine permanently under an alcoholic's nose and in every room of his house*" (I.13). Some are aware of its necessity but feel powerlessness because of their work conditions and complain of time pressure; for instance, as Interviewee 32 mentions, "*The majority of people are caught up in... they are also strangled by time, by this kind of chase, this infernal spiral, we have to go fast. So we do, we do it quickly, but as a result we overconsume*". They also remain passive because digital sobriety is perceived as a difficult process without any obligation, or any framework that builds on a solid base. "*We are well aware that we have too much, but I think we don't know how to do it, we don't know how to do it differently. That's it. We need awareness raising in terms of digital sobriety. That's how I feel*" (I.03). Many remain passive without any formal obligation and think that: "*if I don't get my tool taken away, I tend to say, it's kind of like regulations or like things, nothing will stop me from doing it*" (I.13). That is the reason why Interviewee 14 calls for the automation of many efforts for solving impulsive IT uses. These barriers lead to inaction mainly because people feel powerless, which is a wellknown factor in inaction against climate change in general. Aitken *et al.* (2011) empirically show that feeling powerless leads to downplaying the climate crisis and accordingly decreases intentions to do something for the environment. Information and knowledge about climate change are required to

promote action (Aitken *et al.*, 2011; Farrukh *et al.*, 2022). In the same way, benefiting from clear information about IT pollution and solutions may favour the digital sobriety of users. In addition, some IT users seem to demand a coercive digital sobriety strategy, which appears in contradiction with the participative strategy we discussed previously. This tension between coercive and voluntary green strategies has already been highlighted by Clemens and Douglas (2006), who observe that coercion can lead to voluntary action, showing that both are ultimately interlinked.

4.2.3 Perceived usefulness beyond environmental causes

The utility of digital sobriety is recognised as going beyond environmental causes, which is in line with the polysemous nature of the idea that we described previously. Major effects of digital sobriety are recognised as follows: *“recovering values and the environment, responsible digital can be an incredible opportunity to reknit, recreate values, restore meaning”* (I.04), and *“Digital sobriety is not just about protecting the planet, it is also about protecting the people on it and their health”* (I.12). Digital sobriety is considered as an opportunity for reducing the quantity of emails at work, as noted by Interviewee 1: *“in fact emails bother everyone”*, and accordingly for moderating the mental workload because *“there are people, if we avoided copying them in all the time, we would alleviate their mental overload”* (I.03).

Workers who are involved in optimising their IT uses perceived the combination of all small contributions as useful *“I do my part like a hummingbird”* (I.14) and believe that *“if everyone does it there will be a really big impact”* (I.18).

Those who lead the change generally consider digital sobriety as an easy process as mentioned by Interviewee 18: *“once you start it's pretty easy to stick with it. And I like having a clean, empty mailbox.”* Perception of usefulness and the ease of becoming digitally sober is in line with the definition we set out on the concept. Indeed, digital sobriety seems to be directly related to employee well-being. Digital sobriety seems to be an opportunity to break the vicious cycle of stress of IT workers described by Evenstad (2018) as a result of the acceleration of workload and its related technological progress and the continuous search for optimisation. On the whole, the relationship between digital sobriety and wellbeing is in line with previous research showing that, in general, actions dealing with CSR favour wellbeing at work because they are congruent with employees' values (Singhapakdi *et al.*, 2015).

4.2.4 Different levels of digital sobriety

Our results identify different levels of maturity in digital sobriety, from opposition to sober IT practices to IT disadoption/degrowth. These levels are recognised by Interviewee 2, who observes that: *“there are those who are convinced already because they are personally convinced by the state of the planet in*

general. And then there are those who are not even aware, or even in denial.” Firstly, there is a refutation of digital sobriety. Then there is a level of awareness, with passive people who are stuck in their beliefs and complaints. Next, there are people who try to switch to the best IT solution for reducing their digital footprint. The next level is related to the optimisation of IT by moderating and diminishing the quantity and frequency of its uses. Finally, digital sobriety can lead to a state of IT disadoption or non-adoption, which may be the state which is the most related to degrowth technology. Table 1 presents these different levels with quotations as examples.

Table 1. Summary of different levels of digital sobriety with quotations.

Digital sobriety	Description	Example levels
Refutation	Some IT users may be reluctant to change their habits and behaviours regarding technology due to a lack of	<p><i>“It's okay, I'm not going to change my work methods every 20 years” (I.04)</i></p> <p><i>“In Europe, we are so used to having abundance from a digital point of view, that we don't question using it correctly” (I.07)</i></p>
	negative impacts of excessive IT use	<p><i>“There are some for whom it's a drop in the ocean; they say it's never going to happen; that we have other things to do today; that it's not a priority” (I.02)</i></p>
Inaction	Some IT users may be waiting for action or initiatives from external stakeholders, such as the government, companies, or individuals, rather than taking individual action themselves	<p><i>“In any case, it's too late” or “at our level, we can't change anything” (I.17)</i></p> <p><i>“It's no use, anyway it's always us who have to do everything; it should be the state that sets the example, then it's the industrialists, and then it's the shareholders, and then...” (I.16)</i></p>
	belief in the benefits of doing so or a denial of the	
Substitution	IT users may prioritise and select the most efficient and sustainable IT options based on their environmental	<p><i>“I did the transfer during the day as soon as I had the application, I stopped almost everything by email and I did more by Webex as long as the person in front of me was also registered, which was not always the case” (I.04)</i></p>
	as well as their overall digital footprint	<p><i>“These are really habits to develop, and to say, for example, rather than impact, sending you an email, I'll call you. That's it. The alternative to digital, and there are plenty, there are plenty” (I.03)</i></p>

“The idea is that in fact digital is a non-renewable resource and therefore we must save it. (...) It's a solution for all the challenges we're going to face and it's also a problem when we do anything with it, that we have to preserve it as much as possible, that we have to use it when necessary, to save it” (I.33)

Optimisation	Digital sobriety entails moderating and reducing the frequency of IT use in order to minimise its negative impacts	<i>“It was really easy to remove all the people who were copied and to leave only the two recipients. And that took me, in fact, five seconds” (I.14)</i> <i>“The rules of archiving, not sending heavy documents, sharing on the servers, the webcam, etc. I mean it's pretty simple stuff, yeah” (I.18)</i>
Disadoption	Individuals may choose to discontinue their use of IT, or avoid adopting it altogether, as part of a digital sobriety approach that prioritises a simpler, more intentional, and	<i>“I try to reduce adoption because once you've adopted something, disadopting it is harder than not adopting it because you're used to it” (I.31) and</i>
Degrowth	sustainable lifestyle, or due to concerns about privacy, security, or the impact of technology on their well-being.	<i>“It addresses all sectors – ‘dedigitalisation’” (I.9)</i>

5. Conclusion

Previous studies encourage designers to develop ecologically acceptable, ethical, and wiser technologies to be prepared for the future context of a degrowth society (Pansera *et al.*, 2019; Vetter, 2018). According to Heikkurinen (2018), these acceptable technologies are a matter of identifying a reasonable level of technological support in a degrowth economy. Similarly, our research presents different aspects of acceptable uses of IT for preparing companies and employees to adapt their IT uses in a world of scarcity and a degrowth society. This research is a call for wiser uses of IT as an anticipation of future resource scarcity and energy restriction.

5.1. Contributions

At the end of this study, we characterise digital sobriety as a complex socio-technical trajectory revealing different levels of discontinuance of uses owing to ecological concerns and despite the satisfaction of users with IT. This discontinuance ranges from moderation to abandonment of IT uses, representing different degrees of maturity of IT users in terms of digital sobriety. While the concept of digital maturity has been widely discussed in the academic literature, existing frameworks and models for measuring and assessing an organisation's digital maturity level, such as the Digital Maturity Model by Capgemini Consulting, the Digital Business Maturity Index by MIT Sloan Management Review, and the Digital Maturity Framework by Gartner, often overlook the importance of environmental considerations in digital development. Our research emphasises the need to incorporate environmental considerations into existing models and frameworks, in order to facilitate a more sustainable approach to frenetic digitalisation (Vrain *et al.*, 2022).

This research also offers a characterisation of the implementation of digital sobriety in organisations, highlighting how it tends to happen progressively. Implementing digital sobriety is difficult because it is set in a paradoxical context combining different socio-technical imaginaries opposing techno-optimist economical injunctions, and individual or collective techno-scepticism. We notice that tensions also stem from the potential mismatch between coercive expectations from IT users and the voluntary implementation of digital sobriety. This shows different scenarios for organising digital sobriety in companies with one strategy based on incentives, and another based on obligation and restriction. In the future, combining these divergent scenarios may help address the different contexts of IT use.

Digital sobriety can be considered a complex socio-technical phenomenon with uncertainties regarding IT use forecasting, due to the coexistence of different socio-technical imaginaries. Currently, there are different positions within organisations dealing with digital sobriety, and it is unclear whether the

different levels of digital sobriety will coexist peacefully or lead to tension. Additionally, there is uncertainty as to whether IT will continue to be seen as a solution or as something to be discarded. A future environmental crisis could potentially impose a high level of digital sobriety in an urgent and unprepared manner, leading to massive IT disadoption. Therefore, our findings highlight the need for long-term strategies to address digital sobriety, as it needs to be supported steadily and consistently by organisations, particularly prior to a crisis being declared.

This study addresses the gap identified by Melville (2010), who called for the consideration of environmental beliefs and awareness in IT adoption studies. To explore sober uses of IT, we integrated the TOE framework and IT adoption models. This approach extends previous research on IT discontinuance by examining the trend of IT disadoption through the lens of digital sobriety and its relationship to the degrowth technology phenomenon. Our study highlights the unique socio-technical perspective of digital sobriety, which reflects techno-scepticism and challenges traditional approaches in the fields of Green IT and Management Information Systems (MIS). We question the definition of continuance of IT uses and the role of techno-scepticism in MIS research. While digital sobriety appears to contradict traditional IT adoption approaches, our empirical results demonstrate that traditional factors, such as perceived usefulness, still apply in the context of degrowth technology.

The need for further research on how to moderate and promote the abandonment of IT use for sustainability is crucial. This perspective on digital transformation seeks to encourage responsible and thoughtful use of IT, rather than maximising its support in all work activities. It is also an invitation to redefine effective IT adoption as responsible IT adoption, which takes into account sustainability and environmental impact, rather than solely relying on the frequency of IT use as a measure of success. To further explore the changes in IT uses and perception of IT contribution in line with digital sobriety, it would be beneficial for a theoretical paper to delve deeper into the literature on socio-material imaginaries and degrowth technology. Although briefly mentioned here, these concepts are crucial for expanding our understanding of how technology and society interact, and how we can move towards more sustainable digital practices. By examining the intersection of these ideas with digital sobriety, a theoretical paper could provide valuable insights and contribute to the development of more responsible and ethical approaches to technology.

5.2. Managerial implications

This study highlights the benefits of implementing digital sobriety practices for both human resources and the environment. The findings suggest that companies could use their digital sobriety policy as a

means to attract job candidates. Therefore, it is recommended that companies communicate their digital sobriety policy to potential recruits. Moreover, interviewees indicated that adopting a digital sobriety approach helped reduce their mental workload. This is significant as mental workload has been linked to employee well-being (Cinaz *et al.*, 2013; Grech *et al.*, 2009), which could serve as another incentive for managers to implement digital sobriety practices.

Our results reveal five levels of digital sobriety that organisations may have to support differently. For example, in the refutation stage, the primary objective is to make employees aware of the challenges of digital sobriety, before proposing that they act.

Digital sobriety is emerging as a new challenge for creating social change. However, the results of this study indicate that the implementation of a digital sobriety approach in organisations is still in its early stages. The resistance of some respondents to digital sobriety raises questions about the place of these topics in educational programmes. In the context of the climate emergency, it is essential to introduce this issue into the academic sphere. Future research could explore the potential impact of introducing digital sobriety into educational programmes and raising awareness through workshops in organisations. It would also be valuable to investigate the reasons behind the resistance to digital sobriety among respondents, and to identify strategies to overcome this resistance. Additionally, workshops to raise awareness about digital sobriety could be conducted in organisations. Some initiatives, such as those led by Climate Fresk, are already beginning to emerge in some organisations. As digital sobriety is a new and evolving concept, continued research could provide valuable insights into its potential for creating social change in the context of the climate emergency. Finally, it may be worthwhile to investigate and evaluate the effectiveness of existing initiatives such as those led by Climate Fresk in promoting digital sobriety in organisations.

In addition to reducing the environmental impact of digital technologies, digital sobriety can also contribute to social change in various ways. For example, it can help address issues related to the digital divide, which refers to unequal access to technology and digital skills. By promoting digital sobriety, organisations and individuals can prioritise the essential use of technology, which may help bridge the gap between those who have access and those who do not. Moreover, digital sobriety can also contribute to promoting more ethical and responsible use of technology. For instance, it can encourage individuals and organisations to reflect on the impact of technology on mental health and well-being and take steps to mitigate any negative effects. Digital sobriety can also encourage more thoughtful and intentional use of social media, which can help counteract some of the negative effects associated with social media use, such as addiction, cyberbullying, and disinformation. Overall, digital sobriety has the potential to

contribute to a more sustainable and equitable digital society by encouraging more responsible and thoughtful use of technology.

5.3. Limitations and future research

This research reveals several limitations which offer many avenues for future research. Firstly, we chose to focus on IT companies, but they provide a fragmented vision of digital sobriety practices. This study could be extended to other sectors.

Secondly, the results revealed that companies tend to rely on positive incentives for implementing digital sobriety, despite some IT users expecting coercion. Therefore, an experimental approach could be beneficial in comparing the effects of positive incentives versus coercion in promoting the implementation of digital sobriety. To explore the efficacy of positive incentives, the study could consider using nudges, whose effectiveness has already been demonstrated in the environmental domain (Allcott, 2011; Ayres *et al.*, 2013; Schultz *et al.*, 2007).

Thirdly, Jones *et al.* (2014) have shown that CSR can be used as an employer branding strategy. Exploring the potential for an advanced approach to digital sobriety to serve as an employer branding strategy would be a valuable area for further investigation.

Finally, we acknowledge that institutional conditions can impede digital sobriety. While our data primarily focused on the individual perspective, we recognise the significance of exploring the broader institutional context that shapes behaviour in organisations. As such, institutional factors must be considered when designing measures to promote digital sobriety in organisations.

Appendices

Appendix A: List of semi-structured interviews

#	Respondant's function	Duration (minutes)
I.01	Innovation & Corporate Social Responsibility (CSR) director	54
I.02	CSR officer	43
I.03	Innovation & CSR manager	28
I.04	Continuous improvement and innovation project manager	55
I.05	Life Cycle Assessment (LCA) manager & Digital consultant	56
I.06	Innovation & CSR manager	57

I.07	Enterprise solutions deployment project manager	59
I.08	Ecological transition actor	47
I.09	Research engineer	58
I.10	CSR project manager	68
I.11	CSR manager	50
I.12	Project management officer (PMO) - Digital Communication & Environment	62
I.13	Technical project manager	59
I.14	Senior client manager	64
I.15	Customer affairs manager	55
I.16	Project manager	59
I.17	Business Intelligence (BI) analyst and CSR officer	40
I.18	Consulting manager	36
I.19	Sales advisor	17
I.20	Executive officer – CSR	57
I.21	Analyst programmer	39
I.22	Senior solutions consultant - CSR ambassador	36
I.23	Senior consultant specialising in the public sector	43
I.24	Research analyst	14
I.25	Manager of organisations and transformation	44
I.26	Senior research engineer	29
I.27	Specialist in media technologies and workflow	59
I.28	Deputy director of research centre - Researcher	54
I.29	Teaching engineer	44
I.30	IT Architect	32
I.31	CSR Manager - Researcher	75
I.32	Purchasing and markets manager	55
I.33	Responsible digital consultant	30

Appendix B: Research questions and related interview questions

RQ	Dimensions	Questions	Themes
“What is digital Technology =		If I talk to you about digital sobriety, what does it	Digital

sobriety?” and	digital sobriety	mean to you?	sobriety
“How is it			Digital
implemented in	context		the
	Organisation	What place does digital technology occupy in current CSR organisation?”	ecological concerns in our society?
		Is the reduction/moderation of IT use at the heart of your priorities?	Green sobriety
		Are actions taken here to encourage digital sobriety? Can you explain this process of reduction/moderation of IT uses?	Actions Management
	Environment	What are your sources of information and influences dealing with digital sobriety?	Source when
How is digital sobriety perceived by IT users in the organisation?	Intention	Do you feel concerned about digital sobriety?	Intention
	Facility	Is digital sobriety easy to implement?	Facility
	Utility	Do you think your actions are helpful in terms of sobriety?	Utility digital

References

- Aitken, C., Chapman, R., & McClure, J. (2011). Climate change, powerlessness and the commons dilemma: Assessing New Zealanders’ preparedness to act. *Global Environmental Change, 21*(2), 752–760. <https://doi.org/10.1016/j.gloenvcha.2011.01.002>
- Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics, 95*(9–10), 1082–1095. <https://doi.org/10.1016/j.jpubeco.2011.03.003>
- Anthony Jr, B. (2020). Green information systems refraction for corporate ecological responsibility reflection in ICT based firms: Explicating technology organization environment framework. *Journal of Cases on Information Technology, 22*(1), 14–37. <https://doi.org/10.4018/JCIT.2020010102>
- Asayama, S., & Ishii, A. (2017). Selling stories of techno-optimism? The role of narratives on discursive construction of carbon capture and storage in the Japanese media. *Energy Research & Social Science, 31*, 50–59. <https://doi.org/10.1016/j.erss.2017.06.010>
- Ayres, I., Raseman, S., & Shih, A. (2013). Evidence from two large field experiments that peer comparison feedback can reduce residential energy usage. *The Journal of Law, Economics, and Organization, 29*(5), 992–1022. <https://doi.org/10.1093/jleo/ews020>
- Baumgartner, R. J., & Ebner, D. (2010). Corporate sustainability strategies: Sustainability profiles and maturity levels. *Sustainable Development, 18*(2), 76–89. <https://doi.org/10.1002/sd.447>
- Berkhout, F., & Hertin, J. (2004). De-materialising and re-materialising: Digital technologies and the environment. *Futures, 36*(8), 903–920. <https://doi.org/10.1016/j.futures.2004.01.003>

- Bhattacharjee, A., & Premkumar, G. (2004). Understanding changes in belief and attitude toward information technology usage: A theoretical model and longitudinal test. *MIS Quarterly*, 229–254. <https://doi.org/10.2307/25148634>
- Borning, A., Friedman, B., & Logler, N. (2020). The 'invisible' materiality of information technology. *Communications of the ACM*, 63(6), 57–64. <https://doi.org/10.1145/3360647>
- Boschetti, F., Price, J., & Walker, I. (2016). Myths of the future and scenario archetypes. *Technological Forecasting and Social Change*, 111, 76-85. <https://doi.org/10.1016/j.techfore.2016.06.009>
- Bose, R., & Luo, X. (2011). Integrative framework for assessing firms' potential to undertake Green IT initiatives via virtualization—A theoretical perspective. *The Journal of Strategic Information Systems*, 20(1), 38–54. <https://doi.org/10.1016/j.jsis.2011.01.003>
- Breyer, C., Heinonen, S., & Ruotsalainen, J. (2017). New consciousness: A societal and energetic vision for rebalancing humankind within the limits of planet Earth. *Technological Forecasting and Social Change*, 114, 7-15. <https://doi.org/10.1016/j.techfore.2016.06.029>
- Castro, G. D. R., Fernandez, M. C. G., & Colsa, Á. U. (2021). Unleashing the convergence amid digitalization and sustainability towards pursuing the Sustainable Development Goals (SDGs): A holistic review. *Journal of Cleaner Production*, 280, 122204. <https://doi.org/10.1016/j.jclepro.2020.122204>
- Cheng, X., Hu, Y., & Varga, L. (2022). 5G network deployment and the associated energy consumption in the UK: A complex systems' exploration. *Technological Forecasting and Social Change*, 180, 121672. <https://doi.org/10.1016/j.techfore.2022.121672>
- Chugh, R., Wibowo, S., & Grandhi, S. (2016). Environmentally sustainable Information and Communication Technology usage: Awareness and practices of Indian Information and Communication Technology professionals. *Journal of Cleaner Production*, 131, 435–446. <https://doi.org/10.1016/j.jclepro.2016.05.004>
- Cinaz, B., Arnrich, B., La Marca, R., & Tröster, G. (2013). Monitoring of mental workload levels during an everyday life office-work scenario. *Personal and Ubiquitous Computing*, 17(2), 229–239. <https://doi.org/10.1007/s00779-011-0466-1>
- Clemens, B., & Douglas, T. J. (2006). Does coercion drive firms to adopt 'voluntary' green initiatives? Relationships among coercion, superior firm resources, and voluntary green initiatives. *Journal of Business Research*, 59(4), 483–491. <https://doi.org/10.1016/j.jbusres.2005.09.016>
- Collins, C. J., & Stevens, C. K. (2002). The relationship between early recruitment-related activities and the application decisions of new labor-market entrants: A brand equity approach to recruitment. *Journal of Applied Psychology*, 87(6), 1121. <https://psycnet.apa.org/doi/10.1037/00219010.87.6.1121>
- Culot, G., Nassimbeni, G., Orzes, G. Sartor, M. (2020). Behind the definition of Industry 4.0: Analysis and open questions. *International Journal of Production Economics*, 226, 107617. <https://doi.org/10.1016/j.ijpe.2020.107617>
- DePietro, R., Wiarda, E., & Fleischer, M. (1990). The context for change: Organization, technology and environment. In *Tornatzky L. G., M. Fleischer, eds. The processes of technological innovation* (pp. 151–175). Lexington Books.

- Dorr, A. (2017). Common Errors in Reasoning about the Future: Three Informal Fallacies. *Technological Forecasting and Social Change*, 116, 322–30. <https://doi.org/10.1016/j.techfore.2016.06.018>.
- Elgaaied-Gambier, L., Bertrandias, L., & Bernard, Y. (2020). Cutting the Internet's Environmental Footprint: An Analysis of Consumers' Self-Attribution of Responsibility. *Journal of Interactive Marketing*, 50, 120–135. <https://doi.org/10.1016/j.intmar.2020.02.001>
- Evenstad, S. B. N. (2018). The virtuous circle of ephemeralization and the vicious circle of stress: A systemic perspective on ICT worker burnout. *Futures*, 103, 61–72. <https://doi.org/10.1016/j.futures.2018.03.013>
- Farrukh, M., Ansari, N., Raza, A., Wu, Y., & Wang, H. (2022). Fostering employee's pro-environmental behavior through green transformational leadership, green human resource management and environmental knowledge. *Technological Forecasting and Social Change*, 179, 121643. <https://doi.org/10.1016/j.techfore.2022.121643>
- Freitag, C., Berners-Lee, M., Widdicks, K., Knowles, B., Blair, G. S., & Friday, A. (2021). The real climate and transformative impact of ICT: A critique of estimates, trends, and regulations. *Patterns*, 2(9), 100340. <https://doi.org/10.1016/j.patter.2021.100340>
- Gnanasekaran, V., Fridtun, H. T., Hatlen, H., Langøy, M. M., Syrstad, A., Subramanian, S., & De Moor, K. (2021). Digital carbon footprint awareness among digital natives: An exploratory study. *Norsk IKT-Konferanse for Forskning Og Utdanning*, 1, 99–112.
- Grech, M. R., Neal, A., Yeo, G., Humphreys, M., & Smith, S. (2009). An examination of the relationship between workload and fatigue within and across consecutive days of work: Is the relationship static or dynamic? *Journal of Occupational Health Psychology*, 14(3), 231. <https://psycnet.apa.org/doi/10.1037/a0014952>
- Guillard, V. (2021). Towards a society of sobriety: Conditions for a change in consumer behavior. *Field Actions Science Reports, Special Issue 23*, 36–39.
- Haldar, A., & Sethi, N. (2022). Environmental effects of Information and Communication Technology Exploring the roles of renewable energy, innovation, trade and financial development. *Renewable and Sustainable Energy Reviews*, 153, 111754. <https://doi.org/10.1016/j.rser.2021.111754>
- He, T., Liu, M. J., Phang, C. W., Luo, J. (2022). Toward social enterprise sustainability: The role of digital hybridity. *Technological Forecasting and Social Change*, 175, 121360. <https://doi.org/10.1016/j.techfore.2021.121360>.
- Heikkurinen, P. (2018). Degrowth by Means of Technology? A Treatise for an Ethos of Releasement. *Journal of Cleaner Production*, 197, 1654–65. <https://doi.org/10.1016/j.jclepro.2016.07.070>.
- Hermann, R. R., Pansera, M., Nogueira, L. A., & Monteiro, M. (2022). Socio-technical imaginaries of a circular economy in governmental discourse and among science, technology, and innovation actors: A Norwegian case study. *Technological Forecasting and Social Change*, 183, 121903. <https://doi.org/10.1016/j.techfore.2022.121903>
- Horner, N. C. (2016). *Powering the Information Age: Metrics, social cost optimization strategies, and indirect effects related to data center energy use* [PhD Thesis]. Carnegie Mellon University.
- IEA. *Data Centres and Data Transmission Networks*. IEA: International Energy Agency. (2021, September) <https://www.iea.org/reports/data-centres-and-data-transmission-networks> (Accessed December, 12th, 2021)

- Itten, R., Hischier, R., Andrae, A. S., Bieser, J. C., Cabernard, L., Falke, A., Ferreboeuf, H., Hilty, L. M., Keller, R. L., & Lees-Perasso, E. (2020). Digital transformation—Life cycle assessment of digital services, multifunctional devices and cloud computing. *The International Journal of Life Cycle Assessment*, 25(10), 2093–2098. <https://doi.org/10.1007/s11367-020-01801-0>
- Jasanoff, S., & Kim, S.-H. (2009). Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea. *Minerva*, 47(2), 119–146. <https://doi.org/10.1007/s11024-0099124-4>
- Jones, D., Willness, C., & Madey, S. (2014). Why are job seekers attracted by corporate social performance? Experimental and field tests of three signal-based mechanisms, *Academy of Management Journal*, 57(2), 383-404
- Kerschner, C., Wächter, P., Nierling, L., & Ehlers, M.-H. (2018). Degrowth and Technology: Towards feasible, viable, appropriate and convivial imaginaries. *Journal of Cleaner Production*, 197, 1619–1636. <https://doi.org/10.1016/j.jclepro.2018.07.147>
- Kivimaa, P., Boon, W., Hyysalo, S., & Klerkx, L. (2019). Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. *Research Policy*, 48(4), 1062–1075. <https://doi.org/10.1016/j.respol.2018.10.006>
- Knox, S., & Freeman, C. (2006). Measuring and managing employer brand image in the service industry. *Journal of Marketing Management*, 22(7–8), 695–716. <https://doi.org/10.1362/026725706778612103>
- Konrad, K., & Böhle, K. (2019). Socio-technical futures and the governance of innovation processes—An introduction to the special issue. *Futures*, 109, 101–107. <https://doi.org/10.1016/j.futures.2019.03.003>
- Lammers, T., Rashid, L., Kratzer, J., & Voinov, A. (2022). An analysis of the sustainability goals of digital technology start-ups in Berlin. *Technological Forecasting and Social Change*, 185, 122096. <https://doi.org/10.1016/j.techfore.2022.122096>
- Leal Filho, W., Wall, T., Mucova, S. A. R., Nagy, G. J., Balogun, A. L., Luetz, J. M., Ng, A. W., Kovaleva, M., Azam, F. M. S., & Alves, F. (2022). Deploying artificial intelligence for climate change adaptation. *Technological Forecasting and Social Change*, 180, 121662. <https://doi.org/10.1016/j.techfore.2022.121662>
- March, H. (2018). The Smart City and other ICT-led techno-imaginaries: Any room for dialogue with Degrowth? *Journal of Cleaner Production*, 197, 1694–1703. <https://doi.org/10.1016/j.jclepro.2016.09.154>
- Melville, N. P. (2010). Information systems innovation for environmental sustainability. *MIS Quarterly*, 34(1), 1–21. <https://doi.org/10.2307/20721412>
- Miles, M. B., Huberman, A. M., & Saldana, J. (2013). *Qualitative Data Analysis*. Sage Publications Ltd.
- Morgan, D. L. (2008). Sample. In L. M. Given, *The Sage Encyclopedia of Qualitative Research Methods*. (pp. 797–798). SAGE Publications Ltd.
- Mouakket, S., & Aboelmaged, M. (2021). Factors influencing green information technology adoption: A multi-level perspective in emerging economies context. *Information Development*, 02666669211048489. <https://doi.org/10.1177/02666669211048489>

- Murugesan, S. (2008). Harnessing green IT: Principles and practices. *IT Professional*, 10(1), 24–33. <https://10.1109/MITP.2008.10>
- Nedbal, D., Wetzlinger, W., Auinger, A., & Wagner, G. (2011). *Sustainable IS initialization through outsourcing: A theory-based approach*. Proceedings of the Seventeenth Americas Conference on Information Systems, Detroit, Michigan.
- Pansera, M., Ehlers, M.-H., & Kerschner, C. (2019). Unlocking wise digital techno-futures: Contributions from the Degrowth community. *Futures*, 114, 102474. <https://doi.org/10.1016/j.futures.2019.102474>
- Rosen, P. (2005). *Acceptance and Rejection: Two Sides of the Same Coin, or Two Different Coins?* DIGIT 2005 Proceedings.
- Rowlands, T., Waddell, N., & McKenna, B. (2016). Are we there yet? A technique to determine theoretical saturation. *Journal of Computer Information Systems*, 56(1), 40–47. <https://doi.org/10.1080/08874417.2015.11645799>
- Saldana, J. (2012). *The coding manual for qualitative researchers*. Sage Publications Ltd.
- Sari, Y., Hidayatno, A., Suzianti, A., Hartono, M., & Susanto, H. (2020). A corporate sustainability maturity model for readiness assessment: A three-step development strategy. *International Journal of Productivity and Performance Management*, 70(5), 1162–1186. <https://doi.org/10.1108/IJPPM10-2019-0481>
- Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science*, 18(5), 429–434. <https://doi.org/10.1111%2Fj.1467-9280.2007.01917.x>
- Singh, M., & Sahu, G. P. (2020). Towards adoption of Green IS: A literature review using classification methodology. *International Journal of Information Management*, 54, 102147. <https://doi.org/10.1016/j.ijinfomgt.2020.102147>
- Singhapakdi, A., Lee, D.-J., Sirgy, M. J., & Senasu, K. (2015). The impact of incongruity between an organization's CSR orientation and its employees' CSR orientation on employees' quality of work life. *Journal of Business Research*, 68(1), 60–66. <https://doi.org/10.1016/j.jbusres.2014.05.007>
- Slaughter, R. A. (2018). The IT Revolution Reassessed Part One: Literature Review and Key Issues. *Futures*, 96, 115–123. <https://doi.org/10.1016/j.futures.2017.12.006>.
- Smith, W. K., & Lewis, M. W. (2011). Toward a theory of paradox: A dynamic equilibrium model of organizing. *Academy of Management Review*, 36(2), 381–403. <https://doi.org/10.5465/amr.2009.0223>
- The Shift Project. *Publication du rapport 'Déployer la sobriété numérique'*. (2020, October 14). <https://theshiftproject.org/article/deployer-la-sobriete-numerique-rapport-shift/> (Accessed November, 20th 2021)
- Tomlinson, B., Blevis, E., Nardi, B., Patterson, D. J., Silberman, M. S., & Pan, Y. (2013). Collapse informatics and practice: Theory, method, and design. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 20(4), 1–26. <https://doi.org/10.1145/2493431>
- Trimi, S., & Park, S.-H. (2013). Green IT: Practices of leading firms and NGOs. *Service Business*, 7(3), 363–379. <https://doi.org/10.1007/s11628-012-0163-9>

- Turel, O. (2015). Quitting the use of a habituated hedonic information system: A theoretical model and empirical examination of Facebook users. *European Journal of Information Systems*, 24(4), 431–446. <https://doi.org/10.1057/ejis.2014.19>
- Turnheim, B., Berkhout, F., Geels, F., Hof, A., McMeekin, A., Nykvist, B., & van Vuuren, D. (2015). Evaluating sustainability transitions pathways: Bridging analytical approaches to address governance challenges. *Global Environmental Change*, 35, 239–253. <https://doi.org/10.1016/j.gloenvcha.2015.08.010>
- United Nations. ‘United Nations Releases Special 2020 Broadcast Calling for Collective Action’, (2020 September). <https://www.un.org/sustainabledevelopment/blog/2020/09/united-nations-calls-forcollective-action-in-special-2020-broadcast/>. (Accessed December, 12th, 2021)
- Vetter, A. (2018). The Matrix of Convivial Technology–Assessing Technologies for Degrowth. *Journal of Cleaner Production*, 197, 1778–1786. <https://doi.org/10.1016/j.jclepro.2017.02.195>.
- Vrain, E., Wilson, C., Andrews, B. (2022). The discontinuance of low carbon digital products and services. *Technological Forecasting and Social Change*, 185, 122051. <https://doi.org/10.1016/j.techfore.2022.122051>
- Xu, X., Thong, J. Y., & Tam, K. Y. (2017). Winning back technology disadopters: Testing a technology readoption model in the context of mobile internet services. *Journal of Management Information Systems*, 34(1), 102–140. <https://doi.org/10.1080/07421222.2017.1297172>