Digital commons for the ecological transition: Promises, practices and policies

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SUMMARY

The 'double' – digital and ecological – transition keeps being talked about, yet the environmental footprint of digital technologies has not diminished. Can the climate disaster and the erosion of biodiversity truly be reversed within digital capitalism? Mobilizations at the intersection of the Internet, the social economy and environmental activism denounce the profit maximization and financialization which prevent large firms from developing sustainable digital technologies. Digital commons are then advanced as alternatives prefiguring an ecological and post-capitalist future, based on self-management and common ownership of the means of production. Digital commoners advocate the use of free and open source software to enhance the sustainability of computing devices (e.g., Fairphone). They develop open and collaborative databases (e.g., Open Street Map), which can help govern and evaluate the ecological transition. Finally circular economy and/or degrowth principles can inform the deployment of cooperative platforms (e.g., Mobicoop) and of distributed manufacturing in 'makerspaces'. However these digital commons solutions face four major challenges: their ecological production partly relies on unsustainable Big Tech products; digital capitalism has integrated their critique of intellectual property rights, whilst maintaining its hyper-productivist accumulation regime; their political support is negligible, which in turn affects their capacity to scale up. Our proposed contribution is to provide a response to these contradictions. We combine three research methods: first, we analyse a 'grey literature' corpus that gathers critiques formulated by the digital commons movement against the capitalist mode of production; second, we conduct an ethnography, via observations and interviews with members of two collectives that use digital commons for the ecological transition, Framasoft and Mobicoop; third, we develop an action-research program, in line with our participation in the Digital Commons Policy Council and the Société des Communs, and conduct an exploratory co-construction of strategic campaigns and public policies favourable to the digital commons. Our goal is ultimately to develop tools to augment, and metrics to measure, the expansion of digital commons, in the context of the colossal socio-economic challenges imposed by the global ecological catastrophe.

INTRODUCTION

Over the past decade, a growing number of Information Technology (IT) firms have proposed solutions to address the climate and environmental crises. They promise to reduce pollution and optimise industrial production models via smart grids, precision agriculture, smart cities, and other technological innovations. Some of these firms have also publicised their environmentally responsible practices to reduce the environmental footprint of their activities. These approaches, known as 'IT for green' and 'GreenIT' respectively (Faucheux et al. 2011), have been encouraged by environmental activist mobilisations as well as governmental organisations. This incorporation of ecological issues by industrial, activist and government actors engaged in the digital sector into their discourses, practices, and institutions has been referred to as 'digital ecologisation' (Flipo 2020).

However, despite an apparent consensus regarding the 'indispensable' convergence between the digital and ecological transitions, industrial, activist and government entities are divided on two key questions: (a) to what extent should digitisation orient and drive the ecological transition?, and (b) can this ecological transition be achieved within the framework of the capitalist mode of production? 'Techno-optimist' experts and large IT firms assert that the convergence between the ecological transition and digitisation is possible within the framework of digital capitalism, whereas a number of activists criticise this premise.

In this paper we focus on activists within the digital commons movement ('digital commons' refer to shared digital resources that communities of contributors co-produce by establishing their own governance rules). According to these actors, the ecological transition can only be achieved by reducing our use of digital technologies while simultaneously incorporating them into a post-capitalist mode of production. They argue that digital commons prefigure an ecological and post-capitalist future. Starting in the 1990s, a growing number of online collectives formed to develop free software (e.g., Linux), collaborative databases (e.g., Open Street Maps), and shared knowledge resources (e.g., Wikipedia), thanks to the voluntary contributions of Internet users (Benkler 2006). They now play a key role in the digital economy, as the majority of the world's mobile applications, web servers, and supercomputers rely on them (O'Neil et al. 2021a). Originally, environmental issues were infrequently

addressed by members of the digital commons movement. In the past ten years however, some have sought to put the digital commons at the service of the ecological transition. Digital commoners advocate the use of free and open source software to enhance the sustainability of computing devices (e.g., Fairphone). They develop open and collaborative databases (e.g., Open Street Map), which can help govern and evaluate the ecological transition. Circular economy and/or degrowth principles can also inform the deployment of cooperative platforms (e.g., Mobicoop) and of distributed manufacturing in 'makerspaces' (Kostakis et al. 2018).

However, defining these digital commons solutions as viable alternatives to digital capitalism raises four major issues: (a) their ecological production partly relies on unsustainable 'Big Tech' products; (b) digital capitalism has integrated their critique of intellectual property rights, whilst maintaining its hyper-productivist accumulation regime; (c) their political support is negligible; (d) they mostly remain 'niche' alternatives and are not capable, or willing, to scale up. In order to investigate whether these limits on digital commons' potential to provide an alternative to digital capitalism can be overcome, we employ a diverse range of research methods including ethnography, document analysis, and policy lab experimentation. We begin by presenting the ecological critique of digital capitalism, and in particular that formulated by the digital commons movement (section 1). We then present two case studies of collectives that are trying to use digital commons to support the ecological transition, and analyse the limits of their action (section 2). Finally, we make some proposals to overcome these limits (section 3).

1. THE ECOLOGICAL CRITIQUE OF DIGITAL CAPITALISM

1.1. Early omission of ecological issues

The digital commons movement (e.g. free software activists, Wikipedians, open data and free culture advocates) was originally not overly concerned with ecological issues. In the early 2000s, activists mainly adhered to the notion that the material world and the digital or informational world were separate. For example, early digital commons activists highlighted *information's non-rival status* and thus represented a means of overcoming scarcity (Lessig 2001). They thus shared with Silicon Valley 'evangelists' such as John Perry Barlow, Nicholas Negroponte, and Kevin Kelly the belief that digital

technologies would transcend material limits to economic growth, or at least to the growth of information flows around the globe (Benkler 2006).

The notion of a separation between the material and informational worlds was imbued with a strategic purpose: digital commons activists argued that 'the system of control that we erect for rivalrous resources (land, cars, computers) is not necessarily appropriate for nonrivalrous resources (ideas, music, expression)' (Lessig 2001, p. 95). They insisted that it is, strictly speaking, impossible to 'steal' a non-rivalrous resource, because no one is ever deprived of it. The extension of patentability and the strengthening of copyright were thus seen as absurd measures, ill-suited to the nature of the resources at stake. The abundance of information was presented as antagonistic to the artificial creation of scarcity through intellectual property. While the argument had persuasive force, it obscured the material conditions that made information exchanges possible. In this respect, the commons movement shared with the tech-industrialists and 'Californian ideologues' (Barbrook & Cameron 1996) who launched digital capitalism a denial of the environmental consequences of technological development such as the rising dependence on mineral resources, energy consumption, and CO_2 emissions.

1.2. Integration of ecological issues: GreenIT and IT for green.

In the 2000s and 2010s, online actors began to integrate these issues into their practices and discourses. Some businesses sought to green their industrial practices through the use of renewable energy. Following campaigns by NGOs like Greenpeace - for instance the 'Unfriend Coal' campaign of 2011 - Google and Facebook developed their renewable energy profile and pledged their 'carbon neutrality' (Smalley 2011). So-called 'collaborative economy' initiatives promised to put digital technology at the service of a mutualisation of goods and services (e.g. carpooling, second-hand goods, etc.) which would reduce emissions and waste, thus contributing to the ecological transition.

1.3. Recent critiques of unsustainable technological growth

Since the 2010s, activists have denounced the limits of the 'green growth' championed by Big Tech. The 'carbon neutrality' that firms put forward is an accounting trick, linked to the functioning of the

energy market, rather than a biophysical reality. Firms nominally reduce their greenhouse gas emissions by financing renewable energy projects, which count as 'offsets' for their emissions. Carbon neutrality and greenhouse gas emissions reduction are therefore not synonymous (Roussilhe 2022). Furthermore, the focus on renewable energy overshadows the more fundamental question of the environmental costs of digital technologies, be they the 'cloud', 'artificial intelligence', 'smart cities' or cryptocurrencies (Flipo 2021). Profit maximisation, financialisation and the 'solutionist' mindset that characterises Silicon Valley (Morozov 2013) prevent large firms from developing sustainable technologies (Flipo 2020, Gossart 2015, Veltz 2017). A growing number of activists thus query whether technologies developed by capitalist firms are compatible with the ecological transition. The constant cycles of new technological innovations increase the profits of investors but contradict the technological 'sobriety' that the ecological transition of our modes of production and consumption requires. In this context, the solutions proposed by digital commons activists represent the means to overcome the environmental short-sightedness of digital capitalism.

2. THE ECOLOGICAL PROMISE AND PRACTICE OF DIGITAL COMMONS: TOWARDS TECHNOLOGICAL SOBRIETY

We define 'digital sobriety' as encompassing the following characteristics: (a) Only strictly necessary elements are used in production so as to reduce energy and/or material usage; (b) Energy and materials are used as efficiently as possible (e.g., no streaming); and (c) Energy and materials are produced as sustainably as possible.

Some advocates believe digital commons can play a key role in the ecological transition. Digital commons are advanced as alternatives prefiguring an ecological and post-capitalist future, based on self-management and common ownership of the means of production (Bauwens et al. 2019). This is particularly true of the free software movement, open databases, cooperative platforms and makerspaces. They are developing what we call 'digital commons-based ecological production'. This emerging mode of production would allow for the spread of sobriety, of mutualisation and of the relocalisation of production as part of the ecological transition process.

2.1. Digital commoners advocate the use of free and open source software to enhance the sustainability of computing devices

2.2.1. Framasoft's promise and practice

Framasoft is a French non-profit association.[1] Originally created to defend the use of free software, particularly in the field of education, it has made available to the general public, since 2014, alternative web services which aim to respect the freedoms of users. The most popular are Framaforms (questionnaires), Framapad (collaborative writing) and Framadate (polling). These services were used in 2022 by several hundred thousand people, making Framasoft one of the largest online service providers in France, and even in the world - if we exclude Big Tech products, that is (Framasoft 2022a). Beyond the services it hosts, the association favors a decentralised Internet, which it sees as a remedy to the domination of Big Tech. Framasoft has thus set up a network of alternative service hosts or 'hébergeurs': the Collectif des Hébergeurs Alternatifs, Transparents, Ouverts, Neutres et Solidaires, aka CHATONS ('KITTENS').[2]

Although it is difficult to measure the true ecological impact of Framasoft's services, the association has placed digital sobriety at the heart of its advocacy. Framasoft's services bear some resemblance to the 'low tech' movement (Mateus and Roussilhe 2023). They are relatively light, as they do not involve advertising, and minimise the harvesting of personal data. Moreover, they are hosted by the data center operator Hetzner, which uses mainly renewable energy. Framasoft advocates a reasoned use of digital technology. It considers that the 'future, which the capitalism of surveillance paints today, is neither attractive, nor viable. It considers humans and the planet as resources, and leads straight to their destruction' (Framasoft 2022b). Framasoft seeks to bring into being another world, where digital technology is a controlled, transparent and user-friendly tool that contributes to emancipation' (Ibid.).

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[1] See https://framasoft.org/en/
[2] See https://www.chatons.org/

2.2.1. Framasoft's limits

Framasoft thus associates the defence of the digital commons with an awareness of digital technology's environmental footprint. Despite the broad success of the association's services, there are limitations. The association, which only has ten full time employees, cannot hope to truly compete with Big Tech. Framasoft addresses scaling via a process defined as 'archipellisation': the theory is that thanks to the decentralised emergence of service providers similar to Framasoft, digital alternatives will gain visibility and popularity, while avoiding the problems created by centralisation. In practice, an actor comparable to Framasoft in terms of notoriety and number of users has yet to emerge. Further, hundreds would be needed to meaningfully compete with Big Tech. Clearly 'archipellisation' as it currently stands does not represent a viable digital alternative.

A related limitation is the scarce support the association receives from public authorities. Framasoft has chosen to depend exclusively on donations (98% of its revenue), with 86% of the money collected coming from individual donations (Framasoft 2022a). There is a case to be made that the association should be supported by the State, insofar as it seeks to advance the general interest. Progress in this direction would require, on the one hand, that the association overcomes its ideological reluctance to work with public actors and, on the other hand, that public actors overcome their ideological reluctance to finance such projects. In France, the road will be a long one, given how political and economic elites are still fascinated by Silicon Valley and the start-up model (Lacorne 2019).

2.2. Deployment of cooperative platforms

2.2.1. Mobicoop's promise and practice

Since its emergence in the late 2000s, the 'collaborative economy' promotes the mutualisation of the production of goods and services through digital platforms. This is the case in the transport sector, where carpooling platforms allow drivers to share car space in order to mutualise their journeys. In France, the Blablacar capitalist platform has captured a large part of the long-distance carpooling market, and recently bought a competitor in the daily short-distance carpooling market. Its business

model is to take a commission on the trips arranged through its platform. Its market dominance has been achieved by raising funds to finance technical developments and communication campaigns, then playing on the so-called 'network effect' (the more users there are on the device, the more efficient the device will be). Critics claim that Blablacar's profit-seeking model is pushing it to increase the number of carpoolers on its platform, leading to competition with low-carbon modes of transport such as trains and other forms of public transportation.

To counter this capitalist platform, the Mobicoop association was formed in 2009, and transformed into a cooperative in 2018. It intended to propose an open platform without commissions, based on free software. The promise of this cooperative platform is twofold. First, as a cooperative, Mobicoop's objective is not to increase its turnover, but to meet ecological and solidarity objectives. This implies, in theory, that Mobicoop does not seek to increase the number of carpoolers on its platform at all cost, especially if they could have used decarbonised modes of transport instead. Second, Mobicoop wants to incite different low-carbon mobility actors to cooperate in order to avoid competition and reduce the use of cars (Interview with Bastien Sibille, 01/09/2022).

The cooperative has become a 'société coopérative d'intêret collectif' (SCIC). Introduced in 2001 in France, this status enables entities - unlike traditional cooperatives - to combine different types of stakeholders (which may have different governance powers). Mobicoop could include employees, consumers as well as other stakeholders such as insurance companies, train companies, or local authorities. Mobicoop thus brings together 1,100 cooperators, including public actors. It has developed an open-source platform that can be used commission-free by the 500,000 currently registered drivers and passengers . Its business model is based on the sale of advice and services (such as the customisation of the platform) to firms and local authorities in order for the latter to offer a free service to carpoolers.

2.2.2. Mobicoop's limits

The development of Mobicoop faces two main problems. First, Blablacar has integrated Mobicoop's ecological critique. Not only is the ecological argument becoming more and more prevalent in Blablacar's communication; the capitalist firm is also developing commercial offers that promise to

complement other decarbonised forms of mobility. For example, it has initiated partnerships with some local councils which allow passengers to benefit from a subsidy, if their trips cannot be made by public transport. As Boltanski and Chiapello (2006) have shown, capitalism is capable of transforming itself by integrating its critiques. Since the 1990s, digital capitalism has integrated some of the criticisms formulated by the free software movement: it has understood the benefit of investing in shared resources (like Linux) or of combining the opening of access rights with other forms of monetisation (for example, targeted advertising). Today, digital capitalism has taken on board some ecological critiques and is developing services in the collaborative economy that allow goods and services to be pooled, with the expected benefit of reducing material and energy expenditure in various sectors (mobility, clothing, etc.). New critiques do denounce the impossibility of combining sobriety and capitalist growth, but they are not yet powerful enough and have not found sufficient legislative support to effectively counter the current cultural and economic hegemony of digital capitalism.

Second, Mobicoop is struggling to find public support. Since 2011, Blablacar has successfully lobbied public authorities to obtain favourable legislation and economic policies. In 2018, Blablacar contributed to the drafting of the Mobility Law, which structured the carpooling market. That same year, Blablacar completed a €100 million funding round to which the Société nationale des chemins de fer français (SNCF) participated for an undisclosed amount. In 2022, Blablacar also participated in the creation of the 'National Plan for Everyday Carpooling' with a budget of 150 million euros. Conversely, Mobicoop struggles to obtain public support. Regarding his promise to invite local authorities to participate in the capital of the cooperative, the founder of Mobicoop declared:

> 'We would all like to say that, that's why we created the cooperative, and we will continue to fight for it, but today it is not happening, the local authorities are not in the capital of Mobicoop, or only at a small scale (…) They know how to subsidise an association, they know how to create a semi-public company, yes, they have texts, legal paragraphs, supporting texts, they know how to account for it. But how do they account for their shares in Mobicoop? They don't know how to do it' (Interview with Bastien Sibille, 01/09/2022)

This case highlights that public actor support is often much greater for capitalist platforms than for cooperative platforms. For-profit actors have more means to conduct advocacy campaigns to draft legislation and public policies in their favor. They are also able to leverage their innovative image to obtain funding from public investors, like the Banque publique d'investissement (BPI) in France. Such investors are more likely to finance tech start-ups than cooperatives that develop digital commons, and they lack the legal tools to go beyond the framework of public-private partnerships, for example by taking a share in the capital of a cooperative company whose votes are not proportional to the amount of the financial contribution but established by a specific self-governance.

This shortage of political support has a tangible impact on Mobicoop's ability to scale up. Digital platforms, like other social technologies, are structured by the 'network effect'. This effect means that the more users a platform has, the greater its utility, which attracts new users and so on. This is why platforms invest large amounts of money, even if it means losing money for years, in order to achieve a dominant position where the network effect works in their favour. The legislative support obtained by Blablacar, in addition to significant fund-raising, has enabled it to acquire a quasi-monopolistic position in the car-sharing market that is difficult to counteract for Mobicoop.

2.3. Summing up: Four challenges faced by digital commons

The claim that digital commons represent a sustainable alternative to digital capitalism must contend with a number of interconnected challenges. First, capitalist firms have integrated the commons critique of intellectual property rights (thus neutralising the appeal of digital commons for less politically engaged actors) whilst maintaining a hyper-productivist and unsustainable accumulation regime. Second, in a kind of reverse image of for-profit digital platforms' reliance on infrastructure produced by digital commoners (e.g., FLOSS), the ecological production of activist digital commons projects partly relies on unsustainable Big Tech products such as Apple laptops and phones, or 3D printers produced in China. Third, their political support is negligible, because digital commons are not able to compete with the connections and resources of for-profit entities, as in the case of Mobicoop; or because their ideological focus on maintaining local control at a manageable scale prohibits their comprehensive engagement with State entities, as in the case of Framasoft. Whatever

the case they may be, this leads to the fourth challenge: projects mostly remain 'niche' alternatives which do not scale up and hence fail to constitute a credible alternative to proprietary and/or unsustainable products.

3. PROPOSALS TO OVERCOME THESE CHALLENGES

In line with our participation in the Digital Commons Policy Council[3] and the Société des Communs[4] we conduct an exploratory co-construction of strategic campaigns and public policies favourable to the digital commons. Whilst our end goal is ambitious – we seek to develop tools to augment, and metrics to measure, the expansion of digital commons, in the context of the colossal socio-economic challenges imposed by the global ecological catastrophe – we are conscious of these proposals' summary nature: they should be understood foremost as a platform for discussion.

We start from the premise that digital commons are inherently more 'technologically sober' than for-profit alternatives. This is because the shape of these resources is directed by the requirements of the producing community: the objectives and outcomes of a project primarily reflect the demands of their initial contributors, who are also its prime beneficiaries. On the one hand this means resources are not always, in the first instance, 'user-friendly', so they may be reserved for a technically proficient minority. On the other hand, this integrity of product and process results in exceptional technological robustness and sobriety, since only necessary components are included (DCPC 2022). We propose a program in three parts to address challenges 1 (capitalist integration of the commons critique of intellectual property rights) and 3 (lack of political support). These parts are organised in order of importance and relevance.

3.1. Adopting digital commons

As we saw in the case of Mobicoop, digital platforms seek a dominant position in order to benefit from a network, or primary-entrant effect. For-profit platforms invest capital gathered through fund-

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[3] See https://dcpc.info/
[4] See https://societedescommuns.com

raising and also secure financial and legislative support from the public sector. Cooperative platforms will not be able to develop and compete seriously with capitalist platforms without public support.

This support can take the form of ambitious economic policies such as those implemented in Brussels (e.g. Platform Coop)[5] and Barcelona (e.g. Matchimpulsa).[6] It can also involve the provision of dedicated digital or physical infrastructures (e.g. facilities, parking spaces, etc.), or direct investment by public bodies in the capital of cooperatives. Other forms of State support include developing partnerships with cooperative platforms through public procurement and 'calls for commons'; incentivising civil servant contributions to digital commons, as occurs in France's 10% Etalab program;[7] regional support for distributed manufacturing clusters, or for 'manufactures de proximité' as in France; and EU support for free software to increase product durability (European Working Team on Digital Commons 2022). For such initiatives to expand three key innovations will be necessary:

   a) legal innovation: new legal tools and protocols that facilitate translations and cooperations between the government and communal entities will need to be developed

   b) political innovation: targeted communication campaigns by constituents towards progressive politicians about the ecological sustainability and social benefits of digital commons

   c) cultural innovation: engagement with digital commoners to advocate for the necessity of dealing with the separate sphere and culture of government

3.2. Protecting digital commons

The integrity of some digital commons such as FLOSS is being threatened by predatory corporations seeking to turn value and resources created for all into closed, private goods. Many firms benefit from digital infrastructure without contributing in return (aka 'free riding'). Professional IT media, Big Tech firms and 501(c)(6) foundations such as the Linux Foundation define IT firms and volunteer projects as forming a unified 'community' (O'Neil et al. 2021b). Yet cloud-based systems such as

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[5] See https://platformcoop.brussels/
[6] See https://matchimpulsa.barcelona/
[7] See https://www.10pourcent.etalab.gouv.fr/

Software as a Service (SaaS) introduced by Amazon and other Big Tech firms transform FLOSS, a common resource meant to be shared freely, into a proprietary resource to be sold: the opposite of 'community'.[8] This offers an opportunity to activists: linking the sustainability of FLOSS to ecological sustainability. For example DCPC will conduct in 2023 a follow-up survey of the Debian community (O'Neil et al. 2021c) which will query free and open source software developers about their willingness to work for firms who are engaging in predatory or unsustainable practices.

3.3. Supporting digital commons

Finally, it is important to recognise that there are different justificatory principles for government engagement with digital commons. Some justificatory principles do not consider the sustainability of digital commons, or environmental sustainability. Open Source Software's adoption by industry has resulted in increased instances of security issues owing to insufficient maintenance. Recent cases of security breaches including Equifax, Log4Shell or Open SSL are a direct consequence of many firms 'free riding', or benefiting from this critical infrastructure *gratis*, whilst not contributing to its development or maintenance. Since multiple firms are involved, none feel responsible, resulting in a 'tragedy of digital commons' (Sharma 2023). Yet an argument can be made that government maps private nuclear power or telecommunication infrastructure – why should digital infrastructure be any different? Declaring open source software to be critical infrastructure would help recognise its importance and improve its sustainability. In the US context, one way to do this would be to require firms using open source components to provide Software Bill of Materials (SBOM). Whilst this aim does not directly assist the ecological transition, it does so indirectly, by buttressing the credibility of open source software. The advantage of this strategy is that it aligns with the interests of for-profit entities such as the Linux Foundation, which can effectively lobby firms and governments.

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[8] A note about Software as a Service (SaaS). In a 'traditional' mode, a software program is downloaded and executed by customers on their own hardware. In a SaaS mode, the program is never transferred onto the customers' machines, but is executed remotely on the provider's hardware, and used online (e.g. within a Web browser). Service prevails over use: a subscription to a service is bought, rather than a user licensing agreement being accepted for software copied onto the user's computer. This creates a SaaS 'loophole' in most FOSS licenses, as the service provider is no longer obliged to offer access to the code.

Possible disadvantages include the introduction of stringent compliance requirements about the quality of released software which do not take into account the volunteer status of some participants or the ad hoc nature of some projects. This concern surfaced during current discussions around the proposed EU Cybersecurity Resilience Act.[9] In order to increase the security of critical infrastructure, undue burdens are being placed on developers and projects. For example, the Act states that products with digital elements should be released only if their 'conformity assessments' state that essential cybersecurity requirements are met. The Act's Annex 1 even mentions delivery 'without any known exploitable vulnerabilities' (Vaughan-Nichols 2023). Vulnerabilities frequently emerge post-release: this will have a chilling effect on development. More broadly, the EU clearly needs to be educated about what FLOSS is, and how it is produced.

CONCLUSION: CONFRONTING TECHNOLOGICAL INTOXICATION

Digital commons and capitalist enterprises currently exist in a state of mutual interdependence, each relying on the other for their operations. Capitalist enterprises have the financial and industrial capacity to absorb the commons completely, but little incentive to do so, since they greatly benefit from the innovation and free labour provided by the commons sector. Conversely the most activist components of the commons sector would like nothing more than to 'supersede' capitalism, but lack the economic and political capacity to do so. This stalemate may be broken if the following idea is clearly communicated to a wide audience: *unlimited technological development is environmentally unsustainable*. All persons concerned with the Earth's survival will need to come to terms with the fact that a common future may well depend on technological sobriety: what then of the 'technological intoxication' which lies at the heart of industrial over-development? The deeply held fetish that 'more advanced technology is always better' held by many digital commoners in general, and most free and open source software developers in particular, will need to be confronted.

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[9] See https://digital-strategy.ec.europa.eu/en/policies/cyber-resilience-act

REFERENCES

Barbrook, R. & Cameron, A. (1996). The Californian ideology. *Science as culture*, 6(1), 44-72.

Bauwens, M., Kostakis, V., & Pazaitis, A. (2019). *Peer to peer. The commons manifesto*. University of Westminster Press. https://doi.org/10.16997/book33

Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom*. Yale University Press.

Boltanski, L. & Chiapello, E. (1999). *Le nouvel esprit du capitalisme*. Gallimard.

Digital Commons Policy Council (2022). *Report on the production of digital commons and on the conditions of the organisation and action of the Digital Commons Policy Council*. DCPC/NMRC, University of Canberra. https://doi.org/10.25916/7wbc-4909

European Working Team on Digital Commons (2022). *Towards a sovereign digital infrastructure of commons*. Digital Assembly.

Faucheux, S., & Nicolaï, I. (2011). IT for green and green IT: A proposed typology of eco-innovation. *Ecological Economics*, 70(11), 2020-2027. https://doi.org/10.1016/j.ecolecon.2011.05.019

Flipo, F. (2020). *L'impératif de la sobriété numérique*. Éditions Matériologiques.

Flipo, F. (2021). *La numérisation du monde. Un désastre écologique*. Éditions l'Échappée.

Framasoft (2022a). #Framastats – Framasoft en chiffres, édition 2022. *Framablog*.

Framasoft (2022b). Collectivisons Internet, 3 ans pour voler dans les plumes du capitalisme de surveillance. *Framablog*.

Gossart, C. (2015). Rebound effects and ICT: A review of the literature. In L. M. Hilty & B. Aebischer (Eds.), *ICT innovations for sustainability* (p. 435-448). Springer International Publishing. https://doi.org/10.1007/978-3-319-09228-7_26

Kostakis, V., Latoufis, K., Liarokapis, M. & Bauwens, M. (2018). The convergence of digital commons with local manufacturing from a degrowth perspective: Two illustrative cases. *Journal of Cleaner Production*, 197, 1684-1693. https://doi.org/10.1016/j.jclepro.2016.09.077

Lacorne, D. (2019). *Tous milliardaires! Le rêve français de la Silicon Valley*. Fayard.

Lessig, L. (2001). *The future of ideas: The fate of the commons in a connected World* (1st edition). Random House.

Mateus Q. and Roussilhe G. (2023). *Perspectives low-tech. Comment faire, vivre et s'organiser autrement*. Éditions Divergences.

Morozov E. (2013). To save everything, click here. The folly of technological solutionism. *Public Affairs*.

O'Neil, M., Toupin, S. & Pentzold, C. (2021a). The duality of peer production: Infrastructure for the digital commons, free labor for free-riding firms. In O'Neil, M., Pentzold, C., & Toupin, S. (Eds.) *Handbook of peer production*. Media and Communication Series, Wiley, pp. 3-17.

O'Neil, M., Cai. X, Muselli, L., M., Pailler, F. & Zacchiroli, S. (2021b). *The coproduction of open source software by volunteers and Big Tech firms*. DCPC/NMRC, University of Canberra. https://doi.org/10.25916/r8vg-hd09.

O'Neil M., Zacchiroli S. & de Blanc M. (2021c). *2016 Debian Project survey: Work and volunteers*. DCPC/NMRC, University of Canberra. https://doi.org/10.25916/zgcc-am08.

Roussilhe, G. (2021). Territorialiser les systèmes numériques, l'exemple des centres de données. Working Paper, June.

Sharma, C.J. (2023). The tragedy of the digital commons. Forthcoming, *North Carolina Law Review*.

Smalley, E. (2011). Greenpeace Declares Victory Over Facebook Data Centers. *Wired*.

Vaughan-Nichols, S.J. (2023). EU's Cyber Resilience Act contains a poison pill for open source developers. *The Verge*.

Veltz, P. (2017). *La société hyper-industrielle. Le nouveau capitalisme productif*. Seuil.