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Digital Commons for the Ecological Transition: Ethics, Praxis and Policies

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Abstract: The article seeks to understand how the digital commons movement addresses ecological issues, how its actors incorporate them into their ethics and praxis, and the challenges they face in scaling up to become a viable ecological alternative to digital capitalism. Building on three case studies, we show that the digital commons currently face three major limitations: reliance on unsustainable Big Tech products, inability or unwillingness to scale up, and negligible political support. Based on two Policy Labs we conducted with actors of the digital commons movement, we conclude by outlining proposals to overcome these limits by adopting E.O. Wright's anti-capitalist strategies framework.

Keywords: digital commons, ecological transition, technological sobriety, anti-capitalist strategies

1. Introduction

A core belief of the digital commons movement has long been that technological innovation is key to human progress. Digital commons are shared digital resources that contributors co-produce by establishing their own governance rules. Starting in the 1990s, massively distributed online communities formed to develop free software projects (e.g., Linux), collaborative databases (e.g., OpenStreetMaps), and shared knowledge resources (e.g., Wikipedia). These communities believed that digital technologies – provided they were liberated from the enclosures of intellectual property – would make the world a better place. Knowledge would be made accessible to the many; collaborations would be enabled worldwide; meaningful social relations outside the realm of the market would blossom. Whilst these promises were championed by prominent liberal scholars such as Lawrence Lessig (2001, 2004) and Yochai Benkler (2006), they also served to reinvigorate the Marxist dream of an exit from capitalism made inevitable, or at least plausible, by the development of technical productive forces (Gorz 2008).

This narrative of abundance deserves further scrutiny, and not just because of its utopian sociotechnical overtones. Are constant economic growth and technological innovation truly the best way to tackle the global climate and ecological crises? And should digital technology not be put to work in a more localized and simple manner, oriented towards "degrowth" for example? Indeed, while digital information has specific properties that distinguish it from rivalrous resources such as land or material goods, it is equally important to recognise that the flourishing of the digital is not free of material limits. Digital technologies, whether open source or proprietary, consume non-renewable resources, depend on rare earth minerals, require energy, and emit CO_2. Environmental sustainability and climate warming mitigation thus concern both digital capitalism and the digital commons. Silicon Valley seems ill-suited to deliver the urgently needed ecological transition. As even the *Financial Times* recently admitted, "capitalism won't deliver the energy transition fast enough... There's too much to do, and given the urgency and the need to get the solution right, this isn't a task for your favourite ESG-focused portfolio manager or the tech bros" (Brower, 2023). Can the digital commons do better?

Some activists within the digital commons movement believe the ecological transition can only be achieved by reducing the use of digital technologies while simultaneously incorporating these technologies into a mode of production distinct from digital capitalism (Fuchs, 2022)*.* In the past ten years, a number of these activists have attempted to introduce environmental concerns into the digital commons movement and to place the digital commons at the service of the ecological transition. Three main strategies for greening the digital commons have been adopted so far: the use of free and open source software to make digital devices and services sustainable (e.g., Fairphone[1]), the creation of platform cooperatives to improve the sustainability of the sharing economy (e.g., Fairbnb[2]), and open hardware manufacturing initiatives in distributed workshops that are guided by circular economy and/or degrowth principles (e.g., makerspaces). By and large, these approaches seem to converge on a type of "digital sobriety" that we define as the practices aiming to reduce the production and use of digital technologies, while maximising their efficiency and recycling capacity, to mitigate their material and energy footprints. To be consistent with an emancipatory perspective, digital sobriety, as we defined it, requires two conditions. On the one hand, it calls for an objective assessment of the environmental impact of digital technologies (Pasek, Vaughan and Starosielski 2023). On the other hand, digital sobriety requires a democratic debate about the societal needs that these technologies are intended to meet, favouring "an 'ecology of demand' (degrowth), rather than an 'ecology of supply' (green growth)" (Bihouix 2021, 96).

Nevertheless, these initiatives face daunting questions: is their aim of scaling up to supersede digital capitalism compatible with the digitally sober curtailing of their ecological impact? Can they resist the technological *hubris* that permeates digital capitalism without becoming socially insignificant, confined to a niche for the happy few? Can they develop political alliances powerful enough to compete with Big Tech's extensive lobbying and collusion with governments?

To address these questions, we draw on Erik Olin Wright's (2010, 2019) real utopias and anti-capitalist strategies conceptual framework. Digital commons can be described as "real utopias" that prefigure here and now as a non-capitalist organisation of society (Broca 2013; Sutterlütti and Meretz 2023; Wright 2010). For Wright, real

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[1] See: https://www.fairphone.com/en, accessed on 06 March 2024
[2] See: https://fairbnb.coop, accessed on 06 March 2024

utopias' moral desirability must be accompanied by concrete long-term viability and achievability, within current sociopolitical conditions, e.g., the strategies and the means of social movements which support them (Wright 2010). Thus, our article seeks to investigate whether the digital commons are ecologically viable, and what political strategies are being deployed to support their transformative potential.

We employ two research strategies - ethnography and Policy Lab development (Hinrichs-Krapels et al. 2020) - and focus on the case of France. The French digital commons movement is one of the most advanced in both ecological and strategic terms (O'Neil et al. 2021). We selected one paradigmatic case (Flyvbjerg 2006) for each approach to greening digital commons: Framasoft[3] (free software for ecologically sustainable digital services), Mobicoop[4] (a platform coop for sustainable sharing), and Precious Plastic[5] (open hardware for distributed manufacturing). We conducted a one-year ethnographic survey of each case - between April 2019 and June 2020 for Framasoft,[6] and between June 2022 and June 2023 for the two other case studies - consisting of semi-structured one-hour interviews with the leaders and active members of these organisations (N=9, N=18, N=4 respectively). We then analysed this corpus through applied thematic analysis (Guest et al. 2011).

Next, we examined the anti-capitalist strategies of the French digital commons movement in the context of the ecological transition, and elaborated proposals to enhance them. To avoid any form of idealism, we developed proposals based on this movement's praxis. In line with our participation in the Digital Commons Policy Council,[7] the "digital commons" working group at the Centre Internet et Société research centre[8] and the Société des Communs association,[9] we conducted an exploratory construction of digital commons movement strategies. We organized two one-day Policy Labs on September 24, 2022, at the Town Hall of the 10th arrondissement of Paris, and on November 25, 2022, at the Centre Internet et Société. One hundred (respectively N=28 and N=78) activists, digital commoners, researchers, elected representatives and public officials took part in the Policy labs, including Michel Bauwens, Vasilis Kostakis, the Executive Director of Wikimedia France, the elected official of the 10th arrondissement of Paris in charge of digital issues, and the personal assistant of the French "Digital Ambassador". In the morning, three to five participants showcased current strategies and public policies. In the afternoon, focus groups of 6 to 8 participants refined and complemented these proposals by connecting them to their own practices. After analysis and review, we presented these proposals at various academic (e.g., IAMCR23), activist (e.g., PublicSpaces Conference 2023 for a Collective Internet[10]), and institutional (e.g., Numérique en commun(s) 2022) events. One medium-term outcome of these policy labs has been the establishment of a "French digital commons coalition," comprising representatives from about fifteen digital commons organizations

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[3] See: https://framasoft.org/, accessed on 06 March 2024

[4] See: https://mobicoop.fr/, accessed on 06 March 2024

[5] See: https://www.preciousplastic.com/, accessed on 06 March 2024. Although Precious Plastic is a Dutch initiative, the Head of Innovation is French, and its French community is among the most actives.

[6] The Framasoft ethnography was conducted as part of the research project There Are Platforms As Alternatives (TAPAS) by one of the authors.

[7] See: https://dcpc.info/, accessed on 06 March 2024

[8] See: https://cis.cnrs.fr/en/politics-of-digital-commons/, accessed on 06 March 2024

[9] See: https://societedescommuns.com, accessed on 06 March 2024

[10] See: https://conference.publicspaces.net/en/session/vragen-uit-de-samenleving, accessed on 06 March 2024

(such as Wikimedia France, Framasoft, etc.). Currently, it aims to engage in advocacy efforts and contribute to the public discourse through the publication of op-eds[11]. We are in the process of organizing a third Policy Lab, scheduled for the end of May 2024, with this coalition aimed at engaging more directly with the practical questions regarding how public administrations could support digital commons. This article represents a continuation of this iterative approach and we hope it will stimulate further discussion.

We begin by summarising the digital commons literature to show how ecological issues, whilst initially overlooked, have become an object of growing concern, though they are still seldom studied (section 2). We then present our ethnographies of the three selected case studies and analyse their ecological viability and feasibility. We find that these initiatives face three major limitations: reliance on unsustainable "Big Tech" products, inability or unwillingness to scale up, and negligible political support (section 3). Finally, we present the results of our two Policy lab workshops and outline proposals to overcome these limits, using E.O. Wright's (2010, 2019) anti-capitalist strategies framework (section 4).

2. Ecological Issues in Digital Commons Discourses

Though ideologically and politically diverse, most early advocates considered digital commons as abundant and decoupled from material limitations. It is only in the past decade that commoners have attempted to incorporate ecological concerns into their practice and ethics.

2.1. Early Omission - Digital Commons Against Informational Capitalism: Stallman, Lessig, Benkler (1985-2000)

In the wake of Richard Stallman's (1985) formal definition of the moral imperative to freely share software, digital commons promoters - whether Marxist or liberal, scholars or activists - agreed that digital technologies enabled a world where information is abundant. This often involved separating the material and the digital world. Liberal scholars thus highlighted how information's non-rival status overcame scarcity (Lessig, 2001; Benkler, 2006). They shared with Silicon Valley libertarian "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 (Barlow 1996; Kelly 1998).

The material/digital separation 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 non-rivalrous resources (ideas, music, expression)" (Lessig 2001 p. 95). In other words, it is 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 absurd measures, ill-suited to the nature of these resources. While the argument had persuasive force, it obscured the material conditions that make information exchanges possible. This early digital commons movement shared with tech-industrialists and the "Californian ideologues" of digital capitalism (Barbrook and Cameron, 1996) a denial of the negative environmental consequences of technological development (Turner 2013).

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[11] See: https://www.euractiv.com/section/digital/news/eu-task-force-calls-for-digital-commons-foundation-launch/, accessed on 06 March 2024

2.2. Digital Commons as a Productive Force which Transcends Capitalism: Hardt, Negri, Gorz (2000-2010)

In the 2000s, some Marxist theorists, many within the realm of "Italian Theory", espoused the belief that a world of digital abundance was imminent. Contrary to the liberal view, they believed this abundance was eroding the capitalist valuation process and its reliance on (artificial) scarcity. The commons were thus integrated into a post-capitalist narrative (Hardt and Negri 2004). As Michael Hardt put it, "through the increasing centrality of the common in capitalist production - the production of ideas, affects, social relations, and forms of life - are emerging the conditions and weapons for a communist project. Capital, in other words, is creating its own grave-diggers" (2010, 355). For Nick Dyer-Witheford, "If the cell form of capitalism is the commodity, the cellular [seed] form of a society beyond capital is the common. A commodity is a good produced for sale, a common is a good produced, or conserved, to be shared' (2007, 82). German activists in the Oekonux ("Linux Oekonomy") network similarly believed that the digital commons could not be entirely absorbed by capital and that, at some point, the new logic would supersede the old (Meretz 2013).

The conflict between digital commons and intellectual property was thus recast as a conflict between harbingers of a post-capitalist future and elites desperately trying to save capitalism from its terminal crisis (Broca and O'Neil 2021). French philosopher André Gorz, at the time heavily influenced by the Italian Autonomist tradition, presented free software hackers as embodying "a practical negation of capitalist social relations" (Gorz 2003, 93). He argued that "knowledge and information are, in essence, common goods, belonging to everyone, and therefore cannot become private, commodified property without being mutilated in their usefulness" (Gorz 2008, 19). Thus, the "immaterial" nature of work and digital abundance did not fit into the institutional logic of waged labour and intellectual property rights.

2.3. Exploratory Studies of the Digital Commons Ecologisation (since 2010): Bauwens, Kostakis

Since the 2010s, a growing number of associations and public organisations have raised concerns about the ecological impacts of the digital economy. The main criticisms have been mainly directed towards Big Tech firms, but many of them are also applicable to digital commons. Two responses have been put forward: (a) greenIT, reducing the negative ecological impact of the production, use, and recycling of digital technologies; (b) IT for green, increasing the positive ecological impacts of digital technologies in other sectors, such as agriculture or material manufacturing (Faucheux and Nicolaï, 2011).

It is primarily this second perspective that has been explored by digital commons theorists such as Michel Bauwens and Vasilis Kostakis. They view digital commons as progressive alternatives that foreshadow an ecological and post-capitalist future, centred around self-management and the collective ownership of the means of production (Bauwens et al. 2019). From approximately 2010, Bauwens started to incorporate environmental considerations in his writings. With Vasilis Kostakis, he developed the concept of "cosmolocalism", which refers to the local manufacturing of goods based on globally shared common resources such as modelling software, plans, and wikis (Schismenos et al. 2020). Cosmolocal production in fablabs and makerspaces contributes to the ecological transition in three ways: promoting design-embedded sustainability, enabling on-demand production, and encouraging sharing practices (Kostakis et al. 2018).

While Bauwens and Kostakis, along with other researchers, have conducted case studies to explore the ecological benefits of cosmolocalism (Cindy 2016; Kohtala 2015; Rumpala 2019), few studies have interrogated the conditions for scaling up this mode of production.

3. The Ecological Ethics and Praxis of Digital Commons

Digital commons projects enact three contributions to the ecological transition. The first focuses on extending the lifespan and sustainability of information technologies. The second engages in the sharing economy to safeguard the ecologically beneficial effects of resource pooling, shifting them away from a productivity-driven logic. The third contribution aims to relocalise manufacturing by sharing plans and designs online, which are then used for local workshop production.

This development of what can be called "digital commons-based ecological production" would enable the spread of digital sobriety. In line with Wright's (2010) definition of real utopias, we investigate whether these initiatives are ecologically sustainable by examining three paradigmatic case studies of each contribution (Table 1.). In each case, we focus on the ethics, praxis, and limitations of the initiative.

Digital commons contribution to the ecological transition	Case study
Free software for ICT sustainability	Framasoft
Platform coop engaged in the sharing economy	Mobicoop
Distributed manufacturing based on open hardware	Precious Plastic

Table 1: Selected case studies

3.1. Free Software for ICT Sustainability: Framasoft

3.1.1. Framasoft's Promise and Practice

Framasoft is a French non-profit association which was originally created to defend the use of free software, particularly in the field of education (Gosset 2021). Since 2014, it has made alternative Web services available to the public, 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. The association advocates for a decentralised Internet as a response to the domination of the GAFAM (Google, Amazon, Facebook, Apple, Microsoft). Framasoft has accordingly established a network of alternative service hosts: the Collectif des Hébergeurs Alternatifs, Transparents, Ouverts, Neutres et Solidaires or CHATONS ("KITTENS").[12]

Framasoft advocates a reasoned use of digital technology. It considers that the future, that 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 (Gosset 2021). Framasoft wants to bring into being "another world, where digital technology is a controlled, transparent and user-friendly tool that contributes to emancipation" (*Ibid.* p 58). Although the association has integrated digital sobriety into its

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[12] "Collective of alternative, transparent, open, neutral and supportive hosting providers". See: https://www.chatons.org/, accessed on 06 March 2024

advocacy, it is difficult to measure Framasoft's precise ecological impact. 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 Hetzner, a data centre operator which mainly uses renewable energy.

3.1.2. Framasoft's Limits

Framasoft's services are widely adopted, but there are limitations. Can an association comprising ten full-time employees truly compete with Big Tech? Framasoft addresses scaling via a process defined as "archipellisation": thanks to the decentralised emergence of other similar service providers, digital alternatives will gain visibility and popularity, while avoiding the problems created by centralisation. This perspective on establishing horizontal alliances among independent organizations aligns with the "scaling small" concept developed by Adema and Moore (2021). In practice, an entity comparable to Framasoft in terms of renown and number of users has yet to emerge. Further, hundreds of decentralised providers would be needed to meaningfully compete with Big Tech. Clearly "archipellisation" as it currently stands does not represent a viable alternative to digital capitalism.

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 these funds coming from individual donations. There is a case to be made that the association should be supported by the state, insofar as it seeks to advance the general or public interest. However, this would require bridging the significant cultural and ideological divide which separates it from public actors. In France the road will be a long one, given political elites are still fascinated by Silicon Valley and the start-up model (Lacorne 2019). The same could be said of elites elsewhere, such as the UK's current "tech bro" Prime Minister, Rishi Sunak (Ashcroft 2020).

3.2. Platform Coops Engaged in the Sharing Economy: Mobicoop

3.2.1. Mobicoop's Promise and Practice

Mobicoop is a cooperative whose carpooling platform was developed under an open-source license. The project emerged in 2009 as a response to the creation of a capitalist platform that would later become Blablacar, which now dominates the carpooling market across Europe. The founders of Mobicoop sought to create this alternative for two reasons. First, Blablacar transformed carpooling practices, which were previously based on the gift economy and the solidarity economy, into a commodified system enabling it to levy commissions. Second, Blablacar, whose valuation now exceeds €1 billion, effectively limits the environmental benefits of carpooling: the need to satisfy investors led the platform to launch advertising and incentivising campaigns aimed at boosting the number of carpoolers. Whilst this might appear beneficial, since pollution from individual cars is reduced, it may generate adverse effects by encouraging drivers to use cars in situations where they may otherwise have opted for more eco-friendly options including bicycles, trains, or other forms of public transport.

Mobicoop promises to be a carpooling platform serving the ecological transition and the solidarity economy. To this end, Mobicoop does not charge commissions on transactions made on its platform, develops the software under an open-source license, and operates as a multi-stakeholder cooperative. Its objective is to encourage low-carbon transportation entities, such as local authorities and train companies, to cooperate to

avoid competition and reduce reliance on individual cars (Interview with Mobicoop founder, 01/09/2022).

Currently, the Mobicoop cooperative has 1,100 members, and its platform is used by 500,000 registered drivers and passengers. Its business model relies on selling advice and services, such as customizing the platform, to firms and local authorities, enabling them to offer a free service to carpoolers. Mobicoop particularly focuses on "short-distance" carpooling trips (home-to-work) to establish its presence in different regions.

3.2.2. Mobicoop's Limits

Mobicoop's economic development and ability to garner political support are limited. In economic terms, several factors reduce the cooperative's ability to achieve substantial growth. Raising funds is challenging for a solidarity economy cooperative when financial investors seek rapid, double-digit returns on investment. This limits Mobicoop's capacity to invest in research and development (to enhance software efficiency), design (to improve user experience), and communication (to attract new users). In contrast, Blablacar quickly raised significant amounts of capital before going public. This enabled buying out competitors, making massive investments to improve the platform, and offering a service whose commission rates were initially low, leading to Blablacar's dominant position. In the carpooling platform market, network effects – whereby mover providers of a good or service accrue ever more users, increasing their value and visibility and new users' motivation to join (Shapiro and Varian 1999) – act as a barrier for new entrants and creates lock-in effects for users. Moreover, Blablacar has countered Mobicoop's ecological criticism, at least rhetorically, and increasingly emphasizes the CO_2-saving benefits of its activity to its customers, investors, and government authorities.

Mobicoop has also struggled to secure financial support from political actors. Initially, the multi-stakeholder cooperative aimed to enrol local communities as members. However, such public-commons partnerships are less institutionalized than public-private partnerships, and many public actors are unaware of the cooperative, or reluctant to invest in its capital. As reported by the cooperative's president, this has led to challenges in obtaining public funding, and Mobicoop's financing options from political sources remain limited:

> "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, local authorities are not part of 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 a Mobicoop founder, 01/09/2022)

Furthermore, national public investors such as the Banque Publique d'Investissement (BPI) are more inclined to finance tech start-ups rather than tech cooperatives that develop digital commons. In 2017, Blablacar completed a €100 million funding round in which the Société nationale des chemins de fer français (SNCF) participated for an undisclosed amount. Finally, the legislative framework established in the past decade to regulate the carpooling market in France heavily favours Blablacar. This can be attributed to the significant resources mobilized by Blablacar to conduct lobbying campaigns when the 2017 and 2022 laws regulating transport were created. Another factor

is the preference of political actors for capitalist platforms. As an illustration, the Uber files - a leaked database of Uber's activities in about 40 countries from 2013 to 2017 - revealed the favourable treatment granted by the French government to capitalist platforms such as Uber, resulting in Uber's dominant position in the French carpool platform market (Henley and Davies 2022).

3.3. Distributed Manufacturing Based on Open Hardware: Precious Plastic

3.3.1. Precious Plastic's Promise and Practice

Precious Plastic is a project aiming to recycle plastic waste through a distributed manufacturing approach. Launched in 2013 by an industrial design student, the project develops machine blueprints for plastic recycling and 3D printing designs for various objects (such as jewellery, furniture, construction modules, etc.) produced using these machines and recycled plastic. By releasing these plans and designs under an open-source license, the project intends to address the plastic pollution challenge in a decentralized and grassroots manner. Licenses impose no usage restrictions, allowing any organisation to utilize these digital commons for commercial or non-commercial purposes. This initiative aligns with the open hardware movement, which applies the ethical principles of open source to material manufacturing (Daly 2016).

The coordinating association has a team of six employees funded by donations and a community of a few hundred engineers and designers actively developing new machine versions (version 5 is set to be released in 2023). The development of these plans involves both community-driven and centralized efforts. While contributors propose innovations or provide feedback on online forums, the core project team provides overall guidance and makes technical decisions. The primary objective thus far has been to ensure that the machines are easy to replicate, manufacture, and repair locally. The production of the machines and objects is carried out by individuals or organisations in a decentralized manner. There is a network of around 1,000 workshops spread across 107 countries that manufacture recycling machines and products made with recycled plastic. According to a survey conducted in 2022, these workshops are supported by 11,000 volunteers, employ 6,441 people, and generate a revenue of $36 million. They have contributed to recycling nearly 600,000 tons of plastic.[13]

3.3.2. Precious Plastic's Limits

The founders and current directors of the project are committed to scaling up. In their 2023 evaluation report, they explicitly emphasized "the crucial aspect of impact".[14] The data reveals a growing number of organisations joining the project annually, from around ten in 2014 to approximately a hundred in 2022, along with a corresponding increase in the volume of recycled plastic. Nevertheless, our interviews revealed three key limitations. First, while the recycling machines were designed to be fabricated autonomously, some components are produced industrially. Most workshops source these parts from Chinese suppliers, resulting in an escalation in the ecological cost of machine production.

Second, some association members sought to expand the project's financial autonomy beyond its reliance on donations. They launched a commercial venture aimed

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[13] By way of comparison, plastic waste represented 2 million tons in 1950 and 380 million tons in 2015, of which 15% is now collected and recycled. Source: https://ourworldindata.org/plastic-pollution, accessed on 06 March 2024

[14] See: https://preciousplastic.com/impact/2023.html, accessed on 06 March 2024

at manufacturing plastic recycling machines for global brands (e.g., Adidas, Ikea, Google) and international organisations (e.g., UNICEF). Although this initiative generated revenue for this team, it fell short of financing other participants, notably those involved in research and development. Consequently, some members chose to leave the association to launch a private plastic recycling company, while the association continues to rely on donations.

Third, the project faces what one association manager referred to as the "tragedy of the digital commons". The machine blueprints are made available online, accompanied by tutorials and how-tos, under open-source licenses. This openness allows individuals and non-profit organisations to access and utilize the plans; it also extends to private companies. As its former Head of Innovation pointed out, "people don't share, either due to lack of time or the usual fear of protecting their development" (Interview, 07/07/2023). Commercial entities such as the Austrian firm Plasticpreneur capitalised on Precious Plastic's open-source plans, creating improvements without reciprocating by sharing their enhancements with the broader community. The under-contribution issue is pervasive within the realm of open-source software and licensing, including in the 3D printing world (Moilanen et al. 2015). Although reciprocity licenses have been proposed as potential solutions, obligating users to contribute back (see section 4.2 below), the leadership of Precious Plastic rejects such licenses to remain aligned with the fundamental principles of open source and to maximize the dissemination of information.

3.4. Summing Up: Three Challenges Faced by Digital Commons

The claim that the digital commons represent a sustainable alternative to digital capitalism must contend with several interconnected challenges. Digital commons do not fully engage in environmentally sustainable practices and technologies. In a kind of mirror 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 and parts produced in China (Precious Plastic).

Digital commons projects also struggle to scale up. Some refuse to expand because of their ideological principles favouring degrowth and decentralisation (Framasoft), while others find it challenging to compete with economic rivals (Mobicoop, Precious Plastic). We have observed that digital economy socio-technical dynamics (e.g., network effects), funding models (e.g., venture capital, public subsidies), and legislative frameworks largely favour digital capitalist firms. Moreover, these firms, which have attempted to neutralize critiques of their ecological impacts, "free-ride" by using digital commons without contributing anything in return, while still maintaining a hyper-productivist and unsustainable accumulation regime (e.g. Plasticpreneur).

Finally, political support for digital commons is negligible. This may be due to the ideological focus of some digital commons actors on maintaining local control at a manageable scale, which hinders comprehensive engagement with state entities (e.g., Framasoft). Additionally, the lobbying resources mobilized by capitalist firms far outweigh those of the digital commons movement, and class homologies facilitate connections between political and economic elites, which are fascinated by the Silicon Valley start-up model from which they derive symbolic and economic benefits (Halpin and Nownes 2021).

In brief, projects mostly remain "niche" alternatives which do not scale up and in some cases rely on unsustainable products: they do not yet constitute a credible alternative to the proprietary and unsustainable products and services of digital capitalism.

4. Anti-Capitalist Strategies of the Digital Commons Movement in the Context of the Ecological Transition

In light of this situation, what can be done? In France, the digital commons movement is trying to address these limitations. Mobicoop's Director is leading a coalition of co-operatives seeking to raise a billion Euros to finance social businesses engaged in the ecological and post-capitalist transformation of the economy. Together with other digital commons movement entities such as Wikimedia France, Framasoft's Director is attempting to secure funding for a full-time "spokesperson" who could represent the movement's interests when dealing with public authorities. In addition to these initiatives, what are the systemic strategies which could support the digital commons movement's ambition to institute an ecologically viable and economically feasible alternative to digital capitalism?

As described in our introduction, we held two one-day Policy Lab workshops in 2022 to identify and refine existing strategies, which brought together activists, digital commoners, researchers, elected representatives and public officials. We structure the resulting strategic proposals according to the anti-capitalist strategies framework developed by Wright (2019). By combining what Wright defines as symbiotic ("from above") and interstitial ("from below") strategies to neutralize capitalist influence on the one hand, with the imperative that the digital commons must be greened on the other, we arrive at four strategies for the digital commons movement:

1. Escaping digital capitalism by experimenting with ecologically viable praxis in digital commons "real utopias";
2. Resisting digital capitalism by safeguarding against its harmful environmental effects and its exploitation of common resources;
3. Reducing the territory of digital capitalism by lobbying public authorities to establish an institutional framework that supports green digital commons real utopias;
4. Domesticating digital capitalism by lobbying public authorities to enact laws and policies that limit its expansion.

Whilst some of these options are already being implemented by some sectors of the digital commons movement, it is conceptually and practically useful to formally outline them. We are conscious of these proposals' summary nature; they should be understood foremost as a platform for discussion.

4.1. Escaping Digital Capitalism: Towards More Ecologically Sober Digital Commons

Wright's (2019) theoretical framework posits that real utopias developing alternatives to capitalism must be viable in the long term. In the present case, this means that digital commons must support the ecological transition of our modes of production and consumption.

Happily, digital commons are inherently more "technologically sober" than capitalist 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).

This digital sobriety praxis is at work in the collectives we have studied. It is also exemplified by projects such as Fairphone, which aims to create smartphones using

materials from "ethical" mines and to combat obsolescence by extending software use for smartphones from the current 2-year-average to 8 years. Nonetheless, our case studies showed the limitations of digital commons' ecological viability: many remain dependent on Big Tech products, whose data production and consumption are far from "sober", and in some cases on significant material and energy resources. As Fairphone's Head of Software Sustainability put it during one of our 2022 Policy Labs: "Even though we're getting better every year, more than 60% of the material we use in Fairphones still comes from mines that we don't consider ethical... That is the reason why a lot of our employees have no Fairphones but dumbphones".

Moving forward, we agree with Kostakis et al. (2018) and with the views expressed by participants in the 2022 Policy Labs: digital sobriety should be systematically adopted by projects for digital commons to become a viable alternative to the unsustainable capitalist technological development. Digital commoners will need to autonomously decide whether to inject sustainability into their projects, document and disseminate best practices, develop collective greenIT skills, build alliances enabling them to relinquish their dependence on Big Tech, and create a shared ecological culture.

4.2. Resisting Capitalist Exploitation: For the Ecological Protectionism of Digital Commons

In the face of capitalist hegemony, Wright (2019) reminds us that it is not enough to propose viable alternatives: one must also commit to resisting this hegemony "from below". One of the key battlegrounds in the digital realm since the 1980s has been the domain of intellectual property rights. The free software movement employed an original "jiu-jitsu" strategy, turning the strength of exclusive intellectual property rights against themselves to mandate inclusive intellectual property rights through free licenses (such as the General Public Licence, or GPL). This critical resistance was then co-opted by firms: Microsoft's "informational capitalism" (firms protect the value of their closed proprietary systems) was superseded by Google's more flexible "digital capitalism" in which firms integrate the commons into their business model (Broca and O'Neil, 2021) and prioritise mobile and cloud business models using big data and artificial intelligence (Birkinbine 2020; Lund and Zukerfeld 2020). Further, new cloud-based mechanisms such as Software as a Service (SaaS) negate the sharing capacity of the GPL. In a SaaS mode, a software program is never downloaded and executed onto the customers' machine, but executed remotely on the provider's hardware. A subscription to a service is bought, rather than a user licensing agreement being accepted. This creates a SaaS "loophole" in the FLOSS principle, as the service provider is no longer obliged to offer access to the code (O'Neil et al. 2021). In the case of Precious Plastic, we found that some firms were using open-source machine plans without contributing back to their development, typical "free-riding" behaviour.

To bolster the legal arsenal of digital commons and safeguard them from capitalist appropriation, legal experts have devised two novel types of licenses (Said Vieira and De Filippi 2014). Reciprocity licenses condition access and usage of the digital commons to user contributions; Copyfarleft licenses such as the Peer Production License (PPL) govern access based on adherence to specific ethical criteria by organisations (e.g., cooperatives are treated differently than firms). Coopcycle, a federation of bicycle delivery platform coops, introduced the Copyleft license in 2020, which permits platform usage solely for delivery services operated by cooperatives using eco-friendly transportation methods such as bicycles.

These licenses represent important new legal tools to resist the appropriation of the digital commons by digital capitalism for non-ecological purposes. However, they conflict with the open logic that has prevailed in the free software movement, which limits their adoption. Following Bauwens et al. (2019), we suggest that, like Coopcycle, digital commons collectives should employ these legal strategies, to shield common resources from capitalist exploitation and to promote eco-friendly practices, achieving what we call the "ecological protectionism of digital commons". While not yet legally effective, Lund and Zukerfeld (2020, 300-301) have also introduced the Commoners License Family (CLF), building on the PPL and modelled on the Creative Commons 'family' model of licenses, which takes a better account of commons-based peer production and aims to defend it better against capitalist exploitation.

4.3. State Support and Contribution to Ecological Digital Commons

While interstitial, "from below" strategies enable both confronting and navigating the spaces within digital capitalist hegemony, the digital commons movement must also engage in symbiotic, "from above" social mobilizations and lobbying practices to enrol support from public actors. Our previous research has documented alliances formed by the digital commons movement with European political parties and public administrations (Shulz 2019). This support is pivotal to mitigate the economic shortcomings of digital commons, by creating a regulatory framework conducive to their flourishing. However, such a regulatory framework has its limitations and also needs strong enforcement and operationalisation: the seemingly sober principle of 'data minimisation' is part of EU data protection law but as Koops (2014) critiques, based on the vast amounts of digital data in existence, "[w]ho in his[sic] right mind can look at the world out there and claim that a principle of data minimisation exists?".

4.3.1. Financial and Economic Policies

The first set of proposals pertains to the financial and material support from public authorities towards eco-friendly alternatives to digital capitalism. Some public entities have already become primary clients of cooperative enterprises that develop eco-friendly digital commons. Public procurement represents a key lever for supporting specific economic actors and practices (Le Crosnier 2021). In the case of Mobicoop, the incorporation of social and environmental criteria limits the cooperative's economic growth but could provide a compelling argument for establishing partnerships with progressive and environmentally conscious local authorities.

Furthermore, local and national public authorities are experimenting with economic policies in favour of digital commons, as demonstrated by successful implementations in Brussels (e.g., Platform Coop[15]) and Barcelona (e.g., Matchimpulsa[16]). National and transnational public investment funds (e.g., European funds) could also direct their investments towards eco-friendly alternatives to digital capitalism. As the 2022 Policy Lab focus groups made clear, these practices are already in use and could be extended. Examples include the French Banque des territoires participation in a fundraising effort for Mobicoop; the "citizen initiatives accelerator fund" of the Ministry responsible for digital affairs, which since 2021 has supported the upscaling of nine digital commons including OpenFoodFacts, an open database aiming to develop a metric for the health impacts and carbon footprint of food products; and the "Manufacture de

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[15] See: https://platformcoop.brussels/, accessed on 06 March 2024
[16] See: https://matchimpulsa.barcelona/about-matchimpulsa-eng/, accessed on 06 March 2024

proximité" economic policy, endowed with €30 million, which has funded a hundred productive shared workspaces to foster the relocalisation of small-scale manufacturing industries based on commons-based peer production.[17]

4.3.2. Public Contributions to Ecological Digital Commons

Beyond financial support, public actors can actively contribute to the development of eco-friendly digital commons. They can become shareholders in cooperative platforms, as exemplified by Mobicoop. By joining and promoting shared governance models, public entities contribute to the development of economic activities that are deeply embedded in the socio-political fabric of local communities. These public-commons partnerships represent an alternative to public-private partnerships (Fattori 2013; see also Dafermos and Kostakis 2015; Shulz 2024).

Public entities can also make public resources available to digital commons projects. This could take the form of local authorities or public universities providing space to host distributed manufacturing collective workshops based on digital commons, as already happens for some French fablabs and makerspaces. In the same spirit, offering free parking for delivery or carpooling services that rely on cooperative platforms is a tangible form of public contribution. Public entities can also allocate space on Web Servers to hosting ecologically-conceived open-source software.

Finally, public actors can actively participate in the development of digital commons that serve the ecological transition. As reported by the director of the French National Institute of Geography during one of our 2022 Policy Labs, "our administration is developing a Human Resources policy aiming to enable civil servants to contribute to digital commons such as OpenStreetMap, which play a critical role in enhancing the understanding of the Anthropocene".

These supportive public policies and contributions sketch out a "partner state" for the digital commons. The "partner-state", a notion popularized by Bauwens et al. (2019), was regularly used by activists and commoners during Policy Labs' focus groups, demonstrating the anchoring of this symbiotic strategy within the French digital commons movement.

4.4. Domesticating Digital Capitalism: Confronting Big Tech's Non-Ecological Practices

An alternative form of symbiotic or "from above" engagement with the state (Wright 2019) seeks to neutralize digital capitalism's environmental harms. By advocating for policies that incentivize and protect eco-friendly digital commons initiatives, the movement can foster a more sustainable and equitable digital landscape via legislative action. The French digital commons movement is thus advocating for the implementation of robust environmental regulations and policies that hold digital corporations accountable for their ecological impacts. This includes pushing for stricter emissions standards, waste management practices, energy efficiency and right-to-repair requirements for digital goods and infrastructure. Fairphone's Head of Software Sustainability outlined during one of our 2022 Policy Labs: "we engaged with French legislators during the drafting of the 2020 smartphone reparability law, and we had to fight significant opposition from big phone makers lobbyist during long meetings". Additionally, lobbying for greater transparency and accountability in the digital product supply chain can help expose and address environmentally harmful Big Tech practices. The 2016 French Digital Republic Act introduced the legal category of "data of general interest",

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[17] See: https://tierslieux.anct.gouv.fr/fr/programme/manufactures-de-proximite/, accessed on 06 March 2024

which public authorities could request from firms (as they already do for public statistics or tax audits) to monitor the ecological impact of their activities, on the one hand, and to obtain data that could be useful for the governance of the ecological transition, on the other. However, as one public official reported during a Policy Lab focus group: "this legislation is underused by public authorities".

The movement should actively support the development and implementation of laws and regulations that promote platform cooperatives. Engaging in legislative battles to challenge the dominance of data-intensive and resource-intensive digital platforms can pave the way for a more sustainable digital ecosystem. By promoting alternative, eco-friendly models and advocating for measures that limit the market power of large digital corporations, the digital commons movement can help level the playing field and create space for environmentally conscious alternatives.

5. Conclusion

In the context of the colossal socio-economic challenges imposed by the global ecological catastrophe, the fact that digital commons are governed by the contributors who produce them means these projects and communities can mandate that their production is digitally sober. For this to happen, the following idea will need to be widely debated: unlimited technological development is environmentally unsustainable. The "technological intoxication" which lies at the heart of industrial over-development takes many forms. The deeply rooted 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 thus need to be confronted. Everyone 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, on the self-governance of digital means of production, and on effective political strategies to oppose an unsustainable digital capitalism. Our consideration of the digital commons shows some ways forward for achieving this environmental sustainability and sobriety for digital technology.

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