European OSS Policy as a Countermeasure to Big Tech Dominance

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1. Executive summary

This policy brief examines the role of open source software ('OSS') in the European Union ('EU') and its potential to enhance digital sovereignty, innovation and efficiency.

OSS offers several advantages over proprietary software, such as:
- Lower costs and higher efficiency;
- Greater transparency and security;
- More alignment with European values and principles.

However, the paper identifies **several challenges that OSS faces**, such as:
- Lack of awareness and visibility about the current and potential roles of open source;
- Lack of funding and incentives to contribute;
- Governance problems in open source project communities.

The paper reviews **existing legal frameworks and policy initiatives at the EU and national levels that support OSS development and adoption**. It highlights:
- The licence system that facilitates the sharing and reuse of OSS across public administrations;
- The Open Source Software Strategy 2020-2023 that outlines the EU's vision and actions for OSS;
- The German Sovereign Tech Fund that provides financial and technical support for OSS projects.

The brief concludes with some **policy recommendations** to improve the current strategy and foster a more robust and diverse OSS ecosystem in Europe to fully harness the benefits of open source software.

The recommendations include:
- Inverting the standards for public procurement of proprietary software and prioritising OSS solutions;
- Improving software catalogues for trusted OSS and increasing their usability;
- Integrating OSS into EU strategic goals and programmes, such as open science, Horizon Europe, Next Generation Internet, and Interoperable Europe Act;
- Scaling up the Sovereign Tech Fund model at transnational, national and regional levels to address specific needs and opportunities.

2.   Introduction & Background

What is open source software?

The term 'open source software' is frequently used to refer to a wide range of products, features, and practices that stand at the heart of our digital infrastructures. According to the Open Source Initiative, a certain number of criteria needs to be met for a piece of software to be officially considered open-source. First, everyone must be allowed to share the software, even when included in other softwares products. Source code should be easily accessible and understandable while modifications and derived works must be allowed. Second, the criteria also include non-discrimination requirements against persons or groups as well as use-cases. Open source software must furthermore not be tied to its use within a specific product, must not restrict the licence models of other software and must be technology neutral ("The Open Source Definition", 2007).

To date, the most widely recognised example of open source software is the operating system Linux, constructed in the early 1990s by Finnish programmer Linus Torvalds (von Harz, 2023). Though it only accounts for a market share of 2.8 % in 2023, Microsoft itself has considered it "a major threat to the dominance of Windows" (Thurrott, 1998) in the past (Taylor, 2023). Further popular open source softwares include the browser Firefox (Mozilla Foundation) and the programming language Python. While this software is used widely, the fact that they are based on open source is less well-known. This "invisibility" might stem from higher marketing and branding efforts of paid solutions. Yet, its widespread adoption shows that open source software is, despite its lower salience, crucial for companies, the public sector, and consumers.

Ideology and practice of open source software

Open source practically dates back to the very origins of the Internet. In the 1960s, at the beginning of the computer age, the purchase of the hardware products included the software needed for its operation for free and, notably, the source code was published with it. Only later, companies started to recognize the potential to monetize their software ("Open Source History", n.d.).
This transformation has led to open source being a subject of activist movements. The Free Software Movement introduced the concept of so-called "free software" which broadens the definition of open software. Free software includes four essential freedoms: running (1), studying (2) and redistributing (3) software as well as building and distributing modified versions (4) of software (What is Free Software?, n.d.). This notion of freedom can be seen as embedded in an internet culture that generally heavily revolves around sharing, be it of memes, videos or code (Aigrain, 2012). Especially in the developer scene, building on solutions found by other developers and shared via forums is essential. Developers are very open to share their projects and enable others to use and build on their existing achievements. The platform GitHub, for example, features over 140 million open-source projects. This culture dates back to as far as the peer-review-centred environment of the ARPANET ("What is open source", 2019).

When it comes to who the individual open source developers are, there is some discrepancy between the USA and Europe. According to a DG Connect study, a special feature of the contributors to open source in Europe is their diversity: The development and maintenance of basic open-source technologies is often the work of individual developers for their inception and successful operation as "one-person stores", in the context of voluntary work or working time provided by employers. In contrast to the United States, for example, where "commits" in projects of commercial significance are most often made by employees of global ICT companies, in the EU the next most common group to contribute to basic code stacks alongside individual developers are employees of small and very small companies (Blind et al, 2021, p. 15).

Indeed, while free and open source software was originally often conceived "by a loose collaboration of volunteer programmers" (Boulanger, 2005, p. 239), enterprises also play a considerable role. They not only enable their employees to work on open source projects but also co-create or co-fund such initiatives. For example, the Mozilla Browser mentioned above started with the company Netscape making their browser open source ("Freeing the source", n.d.).

A reason for this engagement might be the avid use of open source by companies, as according to the Future of Open Source Survey (2015, p. 8), 78% of enterprises offer software based on open source code. Linux is even supported by its rival Microsoft, who invests in and re-uses the Linux kernel for its Azure Cloud product. Similarly, Google uses elements of Linux in cloud, Chromebooks and Android. This involvement becomes very clear when looking at the members of the Linux foundation which include most big international tech companies (King, 2023).

From a public policy perspective, open source enables a value-driven digitalization. The ideas and convictions like freedom, collaboration and efficiency which stand behind open source are generally rather ethical. It also makes use of developers´ good will that goes beyond purely monetary motivation (King, 2023). Fostering open source software on a policy level would be a symbol for what principles governments value in digital infrastructure.

For the public sector itself, open source is a way for cheap public procurement which at the same time enables citizens to co-create their administration´s software. Following that spirit, even software developed by the government should be published under an open source licence. Under the slogan "public money, public code", this argument is put forward by a multitude of civil society actors. An open letter calling for "legislation requiring that publicly financed software developed for the public sector be made publicly available under a Free and Open Source Software licence" (Public Money Public Code, 2023) has reached over 34000 signatures.

Problem with Big Tech proprietary software in the EU

Though software products were sold before that, until 1983, every piece of machine-readable software was essentially open source. The source code itself was subject to copyright, but modifications were freely possible (Wardynski, 2022). That changed with

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the Apple Computer INC v. Franklin Computer Corporation (1983) case, where Apple claimed copyright infringements by Franklin, who copied Apple´s application software and operating system. While an initial ruling sided with Franklin, the United States Court of Appeals ruled that computer programs were subject to copyright.

This formally established the practices of how so-called proprietary software is handled today. Proprietary software can be defined as software whose use, distribution and modification is controlled by its owners according to copyright law. While the right to use proprietary software can be acquired, the software´s IP rights continue to belong to the user. Modifications, e.g. to better meet the needs of the users, cannot be made by the buyer on their own. Similarly, it is impossible to sublicense software licences (Rouse, 2017; Wardynski, 2022).

In today's highly consolidated Internet, a lot of services built on proprietary software that are used by businesses, consumers and the public sector are offered by powerful non-European companies, notably "Big Tech" corporations like Google, Amazon, Facebook, Apple or Microsoft ('GAFAM'). This evokes problems on two dimensions: as a danger for European strategic autonomy, and in terms of economic inefficiencies.

Strategic problems

Big Tech proprietary software poses a problem for European strategic autonomy and security. US and Chinese Big Tech companies´ market power in the EU could be used to exert political pressure on EU countries. Both countries have shown in the past that they are willing to use economic pressure to impose their will. During Donald Trump's presidency, the United States introduced tariffs on European products while China boycotted Lithuanian export products after a diplomatic affront against China. With some software products being essential for European companies or individuals (e.g. MS Office), this could be a weak point within Europe´s strategic autonomy. This has also been brought up in the second edition of the European Commission´s in-depth analysis of strategic dependencies which lists IT software among the five key dependencies (European Commission, 2022, p. 59).

Furthermore, proprietary software´s code is only known to the owner. Unlike for open source software, there is no "auditable source code" (Thieulin, 2019, p. 44). It is rarely given to purchasers (e.g. to assess a potential security risk) and even if they are, there is no guarantee that the code hasn´t been manipulated to pass the assessment. This creates a fundamental lack of transparency. Purchasers cannot be sure that the software does not contain malware or backdoors. The recent debate on potential backdoors in TikTok shows that this is an eminent political issue in the EU and the US.

Economic problems

Additionally to the strategic dependency, there is an economic dependency on Big Tech proprietary software of businesses, consumers and the public sector. To many software products offered by GAFAM, there is no viable proprietary or open source alternative that offers the same service level. Rather, some proprietary software tends to have limited interoperability with solutions by other providers and routinely utilises techniques

to lock-in customers into its own ecosystem. For public sector clients, software providers like Microsoft and Oracle have been found to impose repurchase requirements or force customers to also choose the existing provider for any additional services. Big Tech companies' immense market power enables them to charge higher markups. For example, Microsoft has recently significantly increased its prices for corporate customers. The integration of AI functionalities in current services can be assumed to even deepen the market power of established players (Jahn, 2023).

Even B2C services offered for free (e.g. Google Drive, Google Search, social media) come at the price of data collection (King, 2023). Furthermore, the use of proprietary software poses the same challenge as IP law in general: Schumpeterian economists suggest that the existence of patents creates an incentive for innovation (Boldrin & Levine, 2013, p. 4). Yet, once the innovation is made, forbidding others to modify and re-use existing knowledge leads to an efficiency loss. Similarly, allowing free re-use of existing software would enable re-users to directly build upon the existing solution without having to try to duplicate or reverse-engineer the already existing software. This would constitute an efficiency gain, given that it outweighs any reduction in initial innovation. Indeed, some studies provide evidence that patents in general have negative effects on innovation, especially for high-growth industries (Boldrin & Levine, 2013, pp. 3-4).

This shows that the renewed political interest in open source in Europe is articulated, in parallel, with the stated ambition of building European digital sovereignty. At the heart of technological infrastructures, and therefore key to digital sovereignty, are interoperable software solutions and coherent technological standards. The creation of "physical and software infrastructure that is open and shared in the global digital common" (France Diplomacy, 2022) is thus presented as the fourth pillar of the project of this European technological sovereignty, alongside the security of cyberspace, the legal and economic regulation of the digital market, and the European capacity for innovation. Yet to be able to leverage open source´s strengths, it is crucial to engage with the challenges it is facing.

3.   Policy problem

Challenges that open source is facing

As the pace of technological evolutions keeps accelerating, the foundation that enables it – in large part based on free and open source software ('FOSS') – is struggling to keep up. Many important projects rely on open source software to then focus on higher level innovation: for example, every time someone writes a new piece of software, they will generally not rewrite a timezone conversion algorithm which is already available in a code library and can be used freely. However, if the timezone algorithm is not up to date with a decision of a national parliament of a small country to discard daylight savings time, the software using it will reproduce the same error. Although a timezone algorithm might not pose critical problems, other unmaintained open source projects can have nefarious consequences on projects they are used in – this is for example the

case for encryption algorithms. Thus, sustainability (in the sense of maintenance and constant progress) is crucial for open source projects. Nonetheless, as shown by Maruping et al. in 2019, sustainability is a challenge for open source projects.
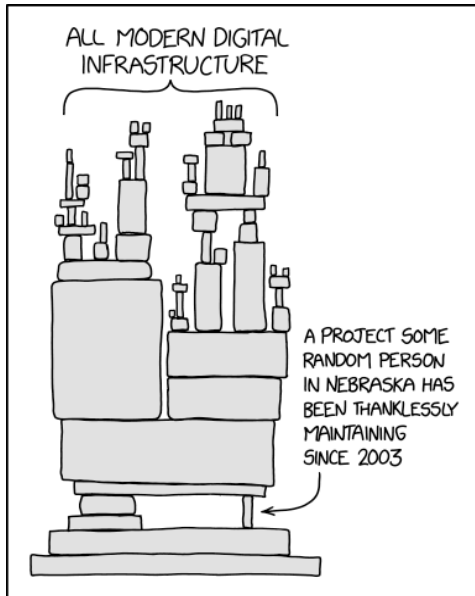
Component dependency. Source: https://xkcd.com/2347/ CC BY-NC 2.5

Elinor Ostrom's studies on common pool resources are a great starting point to study the sustainability of digital commons. Sustainability is in this case defined as "whether these systems can survive over time" (Ostrom & Hess, 2007); or, more precisely, a project is successful if "it produces useful software or else useful software that continues to be developed over time" (Schweik & English, 2012). Open source software projects do have some arguments in their favour: they provide programmers with enjoyment and benefits in the long term (Lerner & Tirole, 2002) by, for example, accelerating their career development as shown by Mindel et al. (2018). However, these arguments can only go so far: according to a study by Fang & Neufeld (2009) titled 'Understanding Sustained Participation in Open Source Software Projects', many open source projects face challenges related to sustainability which can eventually result in failure.

Since open source software is free to use, funding is rarely abundant. Although a considerable proportion of investments in OSS development takes place in the volunteering of human resources, finances do play a role when it comes to the aforementioned sustainability of projects. Funding is needed primarily in two cases

which we will cover one after the other, starting with community management. According to Ostrom, managing the commons is essential for their sustainability: conflict resolution should be accessible, decision making should be participatory (but facilitated nonetheless) and rules for good organisation should be set (Ostrom & Hess, 2007). In open source projects, community management especially focuses on issue and bug treatment, technical debt, maintenance, acceptance of pull requests (new features), management of branches (versions) and releases. As these responsibilities are not sharable and have to be somewhat centralised, they can take up a lot of effort and most of the time require full time involvement. The finances can thus be used to support these roles.

The second expense might be hiring developers to assist with the maintenance and development of OSS. According to a paper published by the Linux Foundation, there is a big "consumption versus contribution imbalance" in open source software development (Eberhardt et. al., 2022, p. 34). In other words, there are a lot more developers, companies and other types of organisations using open source software, than those actively contributing to it and maintaining it. Even contributions such as posting "issues" (bug reports) on the code repositories are often done by a very small set of people. This is in large part caused by the dominance of an innovation discourse which leads to the neglect of maintenance and scaling work: it is more interesting and easier to communicate on the work done in innovation than in infrastructure development.

Open source project sustainability can also be weakened by governance issues if its creators and administrators do not involve the community in crucial decision-making and rather act like benevolent dictators for life. Although these issues are more rare because of the possibilities offered by forks and distributions to dissociate projects from individuals, they can cause serious problems for the long-term development of free and open source software.

These issues might hinder the potential of open source software as a solid answer to proprietary software built by big tech companies. This leads us to ask ourselves whether the legal system of the EU favours this response? The upcoming parts of this policy brief will focus on legal issues surrounding open source as well as best legal and economic practices in supporting these projects, resulting in a set of OSS and digital sovereignty-related policy recommendations.

Policy problem in the EU context

With the rising prominence of OSS over the last twenty years, governments throughout Europe have acknowledged its importance in generating economic benefits for all. A study commissioned by the European Commission examining the impact of OSS revealed that in 2018, across member states, open-source software had an economic impact ranging from €65 to €95 billion, necessitating an investment of merely €1 billion (Blind et al., 2021, p. 15). To address the lack of incentives to develop OSS and its subsequent underproduction, a majority of European states crafted national strategies to incentivize developers to openly publish their work. Prior to delving into the intricacies

of policy development at the European level, it is essential to briefly scrutinise the domestic policies of EU member states.

Policies advocating for OSS can be generally categorised into two distinct categories: internal – policies targeting the public sector, directly influencing the utilisation and implementation of OSS within government institutions; and external – policies focusing on the advancement of OSS within the private sector.

Blind et al. (2021, p. 220) discern two periods of governmental support for OSS in the EU, the first commencing in the early 2000s, when governments primarily concentrated on internal policies with the intent to diminish procurement expenses and bolster the competitiveness of OSS for the public sector. The second period started around 2015, as OSS attained a ubiquitous presence within the private sector. Public institutions began to contemplate the more expansive benefits of OSS, such as utilising it as a means to achieve technological autonomy, expedite digitalization, and enhance transparency in governmental processes. Nevertheless, there exists notable variation in the extent, scope, and aspirations of the policies adopted by different European nations.

France has been at the forefront of open-source policymaking in Europe and has started its efforts in supporting OSS in the early 2000s with the creation of the Agency for the Development of the Electronic Administration (ADEA), formerly known as ATICA. In 2002, the ADULLACT association was notably founded with the aim of promoting and developing the use of OSS for public services (European Commission, 2020, p. 15). The support for OSS within the French administration continued and a key piece of legislation was passed in September 2012 to promote the use of OSS within all of France's public administration. The Circulaire 5608, passed by Jean-Marc Ayrault, then French PM, required all departments to consider using free and open software when procuring new technology and to evaluate whether open alternatives would be possible when making substantial revisions to existing applications. Naggle (2019) demonstrates that the law had a significant impact on the French OSS community, as it was followed by a clear increase in the number of OSS contributions, number of firms using OSS and number of individuals working in IT related jobs.

As of 2021, the French government had published an OSS action plan, founded a catalogue referencing OSS for public services and an interministerial open-source software platform "Socle interministériel des logiciels libres", referencing OSS used in public administrations. However, this lasting support of OSS is mostly geared toward public administrations and support to the industrial/private sector is lagging behind (Blind & al., 2021, p. 240).

While some European countries may not be as actively involved in policy support for open-source software, the momentum is still growing, fuelled by the COVID-19 crisis and escalating geopolitical tensions between China and the United States. These factors have prompted countries like Germany to promote the development of public policies in support of OSS. Historically, Germany has had limited engagement with internal policies regarding open-source software. Although a resolution favouring OSS was passed in 2002, the Federal Ministry of Economy decided to cease preferring OSS over commercial alternatives in 2003. Despite the lack of official government policy,

local governments and ministries continue to utilise OSS, and cities such as Leipzig and Munich have successfully migrated to OSS platforms (European Commission, 2020, p. 22).

In 2022, Germany launched the Sovereign Tech Fund, a significant step forward in supporting OSS. Financed by the German Ministry of Economic Affairs, the fund allocates a total of more than €10 million per year to foster the development of open digital base technologies. The foundational technologies supported by the fund aims at enabling the development of other software.

Those types of national policies, be it for internal or external support can foster economic growth and innovation. However, they suffer from a significant free-riding problem. From a national competitiveness standpoint, the benefits of investments in open-source projects could be reaped by foreign countries, encouraging free-riding behaviours. Nagle (2019, p. 3) mentions that if countries supporting OSS domestically might save some money on technology cost but that other countries are allowed to freely use, funding OSS domestically might be a poor strategy over the long-term.

In an effort to address this issue at a higher level, the European Commission has historically played a role in supporting OSS. Although initially focused on internal policy, the EC has maintained an OSS strategy since December 2000. This strategy has led to various achievements, one notable example being the widespread adoption of the Apache Web Server for the Commission's infrastructure (European Commission, 2023).

The Commission also started to focus on reinforcing the interoperability of software and assessed that "the Commission should lead by example, distribute its own produced software and then encourage the public sector in the Member States to do the same" (Schmitz, 2013, p. 1). To achieve this, they built the European Union Public License (EUPL), a legal instrument for licensing OSS for public administrations and private companies. Since its inception, the EUPL has been updated twice and has been employed for more than 500 software solutions since 2012 (European Commission, 2023a). Although the use of the EUPL is not limited to the private sector, its primary focus, however, remains on public administrations.

In tandem with its internal policy initiatives, the EC also attempted to foster OSS adoption in the private sector through several other policies. One notable example is the ISA² program, which aims to facilitate software interoperability across borders, administrations, and companies. The standardisation of software through open source notably enabled the development of the European Legislation Identifier, a solution designed to standardise legal data across countries and allow users to identify and access legal information throughout Europe (European Commission, 2019).

EU-FOSSA 1 and 2 (Free and Open Source Software Auditing) are other noteworthy EC initiatives, which allocated budgets for auditing the security of the EU's most critical OSS. These efforts were accomplished through bug bounty programs, hackathons, and community engagement, allowing the EC to connect with the private sector and key OSS stakeholders (Blind & al., 2021, p. 230). Lastly, the Next Generation Internet, EC initiative with the goal of shaping Europe's digital development through investments of

more than €250 million in research and innovation also considers that OSS should be at the heart of the project.

Despite the significant efforts made by the European Commission and various national governments to promote OSS adoption, its uptake remains less widespread than it could potentially be. Both the public and private sectors are still heavily reliant on proprietary software. The aforementioned initiatives have laid a foundation for further development in the OSS landscape. To assess how those initiatives can be at the forefront of a widespread development of OSS in Europe, the next sect   ion   will examine existing legal frameworks tackling open source software development.

4.   Existing legal framework

Open Source Software licences and Intellectual Property Law

Under existing European legal frameworks, software is considered to be an intangible product – and can therefore be covered by intellectual property ('IP') frameworks analogously to other product types. In practice, this means that the underlying source code and interface of a software product can be patented or copyrighted by its creators, thus considered their intellectual property. Developed specifically for the specific needs faced by the field of software engineering, special licensing programmes have been developed in order to allow the widest possible – commercial as well as non-commercial – distribution of a software product while still allowing for robust IP protections (European Commission, 2017). To allow for the special features of software products, particularly for their propensity to creatively innovate through permutation, a special system of usage, copy, and distribution licences has been developed to suit the needs of the software industry. This section sets out a brief overview of the main features of common software licences, their most prominent examples, and potential problems licensees may encounter when navigating this legal landscape.

The primary distinction between software licences charts their potential for proprietary modification (European Commission, 2017). So-called permissive licences do allow for the licensed material to be used for the development of a proprietary product as long as it is properly attributed. The popular permissive licences include the Apache License (APLv2), the Massachusetts Institute of Technology Licence (MIT L), or the Berkeley Software Distribution Licence 2-clause (BSD-2-clause), all of which were first formulated in association with notable US-based technological institutions (European Commission, 2017). The Creative Commons BY is also a permissive licence, allowing for modification or reproduction without restriction – as long as the work is rightly distributed. Relatedly, an alternative to choosing a permissive licence is to leave the software at hand unlicensed, and thus attach no conditions on the distribution or permutation of the software.

On the other hand, so-called copyleft licences require any derivative work to be distributed as open-source only, usually under the same licence as the used material. The most copyleft permissive licences can be categorised as 'strong', 'flexible', or

'weak', according to their level of protection (European Commission, 2017). Strong licences, such as the GNU General Public Licence (GPL v3), the GNU Affero General Public Licence (AGPL v3), or the Creative Commons BY-SA require that any product developed upon licensed material be covered by the same licence in case it is distributed, accompanied by the source code. Weak licences, such as the GNU Lesser General Public Licence (LGPL v3), still require the source code and its permutations to be distributed under the same licence, but relax some of these requirements when integrating the product into larger software systems. The Mozilla Public Licence (MPL v2.0) is a file-level alternative, which can be integrated into larger products freely as long as the respective codes are placed in separate files (European Commission, 2017). The European Union Public Licence (EUPL) could be categorised as a 'flexible' middle-ground, which still requires modified material to be distributed under the EUPL licence but allows for more flexibility in cases where licensed code has been integrated into a larger, more complex system, resolving some possible cross-compatibility issues with competing licences. The EUPL licence (and its updated versions) is generally chosen for nearly all EU-funded software projects or digital products developed directly by the European Commission.

The restrictive terms associated with many copyleft licences tend to create notable constraints on commercial developers, who are significantly limited in their ability to monetise software products which adapt material licensed under a copy-left framework. This implies that code licensed under a permissive licence – or, alternatively, under no licence at all – is preferred by commercial developers and considered to be more productive in terms of economic innovation, since it allows for the development of a new product that is fully owned and therefore commercially profitable. Final commercial products, even if they incorporate some elements that were initially unlicensed or distributed under a permissive licence, are protected by so-called proprietary licences. The terms and conditions attached to proprietary software are usually entirely definable by its creator or distributor, and tends to function in executable form only under relatively restrictive end-user licensing agreements (European Commission, 2017).

Yet it is not just the post-integration licensing restrictions that incentivise the industry to prefer unlicenced or permissively licensed code: especially when adapting open-source code from multiple original sources, it is common for conflicts between copy-left licensing terms to arise. The issue of cross-licence compatibility is one that poses a challenge to the dissemination and adaptation of open-source software, especially since the licence landscape is wide and nuanced – and the choice of a licence depends almost exclusively on the personal preference of initial developers (European Commission Joinup, 2023). Resolving conflicts between licensing terms and enforcing the proprietary rights of software is then essentially an issue under contract law, and thus is to be enforced in private litigation or under tort law.

New proposal at EU level

Open Source Software Strategy 2020-2023

Numerous OSS policy initiatives exist at both national and European levels; however, there is no unified legal framework for open source projects in Europe. The closest approximation to one could be the European Commission's Open Source Software Strategy 2020-2023. This document outlines the EC's vision, reaffirms its commitment to OSS, and establishes goals and overarching principles regarding OSS governance in Europe. It also lays out the implementation strategy and clarifies the actions to be taken by the EC. Assessing the strengths and weaknesses of this strategy is essential before addressing the recommended path for EU policy-making.

One of the main objectives of the aforementioned strategy is to make the EC closer to the open-source community and become an active participant in the development of open solutions. This objective is grounded in President von der Leyen's *Political Guidelines for the next Commission*, stating, "It may be too late to replicate hyper-scalers, but it is not too late to achieve technological sovereignty in some critical technology areas." ([European Commission, 2020b, p. 13](#)). None of the GAFAM originated in Europe, resulting in a high dependency on the US for the technical infrastructure of both European administrations and private companies. The OSS strategy assesses that developing the European open source ecosystem could be a solution to "minimises the risk of vendor lock-in and getting caught up in political shenanigans or trade disputes" (European Commission, 2020, p. 5). In addition to the sovereignty issue, developing an European open source ecosystem would open alternative paths for a decentralised information society. The EC also asserts that open-source development should and can be the leading approach for cutting-edge technologies, "from blockchain, high-performance computing, and artificial intelligence to the internet of things" (European Commission, 2020a, p. 5).

The strategy does not only focus on the EC ambition to have competitive open-source alternatives for key technologies but also outlines internal ambitions. It aims to share most of its data and "build a world-class public service" (European Commission, 2020a, p. 7). This vision is reflected in the strategy's governing principles, which promote an internal culture based on open-source and encourage sharing and contributing to the development of open-source solutions whenever possible. This is notably made possible by the EUPL and the aforementioned policies to ensure interoperability. The practical meaning of the Commission's strategic governance is clarified by examining its implementation mechanisms.

An action plan details the most important tools for the implementation of the strategy. First and foremost, the EC set up an Open Source Programme Office, office under the management of the Directorate-General for Informatics that will be tasked with implementing the plan, be a point of contact for stakeholders and push the development of OSS. Its main missions are defined as such in the strategy:

Open source strategy main actions	Impact
Set up Open Source Programme Office	Expedite all activities in the action plan
Set and promote the inner source default	Enable co-creation and collaboration
Enhance the software repository	Enable co-creation and collaboration
Revise software distribution practices	Process simplification; lower cost to society
Enable and create innovation with open-source labs	Drive innovation; encourage co-creation
Develop skills and recruit expertise	Contribute to staff recruitment and retention
Increase outreach to communities	Encourage innovation; improve services
Integrate open source in internal IT governance	Increase organisational efficiency; foster innovation
Ensure security	Increase value of open source to the organisation and society
Encourage and promote inner source	Instrumental to success of strategy and actions

Figure 1: Action plan, OSS Strategy, 2020-2023 (European Commission, 2020a, p. 14)

The action plan features multiple initiatives designed to sustain the OSS culture within the European Commission; however, it may not be as effective in terms of external impact. While the strategy's co-creation and collaboration objectives might ensure that public administrations and European institutions remain at the forefront of OSS, these efforts alone may not be sufficient to persuade private actors to implement changes. On Joinup, the EC platform regrouping OSS, the large majority of solutions available are specifically dedicated to public administrations' usage. The limited scope and targets of those catalogues might limit the facility for private companies to adopt OSS solutions.

The Open Source Program Office platform is similarly geared toward the public sector. The focus given on interoperability between public administrations or monitoring tools for the digitalisation of administrations might provide sufficient resources to public administrations seeking to integrate open source solutions for their administrations. However, it is not convincing that it can effectively serve as a "one-stop shop" for private companies seeking guidance on their OSS endeavours. Given the strategy's ambition to "provide the most flexible platform for software development at the digital frontier" (European Commission, 2020a, p. 5), the action plan provides little insight into the mechanisms giving a competitive edge to European companies in fields like artificial intelligence or blockchain.

5.   Case study: The German Sovereign Tech Fund

The Sovereign Tech Fund (2023) is a successful example of how the public sector can support open source software projects. The fund is financed by the German Federal Ministry for Economic Affairs and Climate Action and was launched in 2022. As stated by Frantziska Brantner, a member of the German Bundestag and Parliamentary State Secretary at the German Federal Ministry for Economic Affairs and Climate Action: "We have developed a new instrument, the Sovereign Tech Fund, which allows us to invest efficiently in Europe's digital sovereignty through safe, sustainable, and resilient fundamental digital technologies in terms of open source. The fund was developed in

a co-creation process and jointly with the open source community and can flexibly respond to user needs. It is intended to sustain and adapt the fund in the years to come." (De l'Économie et de la Protection du Climat, B.W. M. F., 2022, October 2022).

The fund's mission is development, improvement, and maintenance of Open Digital Base Technologies that strengthen the open source ecosystem sustainably. By focusing on security, resilience, technological diversity, and the people behind the projects, the Sovereign Tech Fund supports a wide range of projects and teams such as ones working on TCP/IP, DNS, and HTTP, which are essential for communication and the exchange of information on the web. It also supports programming languages, operating systems, and databases. For example, in their first batch of announced financing, they committed to supporting Bundler which is an essential part of the Ruby programming language. Societal fundamental technologies, such as education software, digital identity management, and e-government systems, are also supported, as they represent the core of most public and private software developments. The Sovereign Tech Fund provides support to SMEs, large collaborative projects and communities, individuals and small teams, and agencies and coaches that are behind the open source software. The fund's approach to support is marked by a strong connection to the community, flexibility in funding, and low-threshold access. The community plays a crucial role in the development of Open Digital Base Technologies, and the Sovereign Tech Fund actively engages with the community for feedback and guidance.

The fund's flexibility in funding means that it can offer different amounts of money depending on the project's needs, ranging from 50 to 500 thousand per project. This flexibility ensures that smaller projects receive adequate funding and that larger projects are not constrained by funding limits. The fund's low-threshold access approach means that the application process is straightforward and accessible to all applicants, regardless of their background or experience. Furthermore, the Sovereign Tech Fund provides coaching, audits, and consulting services to project teams, ensuring that they receive the necessary support and guidance throughout the project's development. The fund's resources amount to 10 million per year, which is a considerable sum that can have a significant impact on the development of Open Digital Base Technologies.

The German initiative is a compelling example of how the public sector can support open source software projects. The fund's support approach, funding flexibility, and access threshold, as well as additional coaching, audits, and consulting services, demonstrate a commitment to the growth and sustainability of the Open Source ecosystem which is needed at both a more local and a supranational level to avoid the pitfalls of free riding and digital common underprovision.

6. Policy recommendations

Improvements to the current strategy

Inverting the standards for public procurement of proprietary software

While commercial – and therefore closed-source and often proprietary – software remains the norm in the private as well as public sector, OSS alternatives often either already exist or are relatively easy to develop. Due to salience as well as convenience, public procurement of software solutions often lands on pre-packaged commercial solutions (frequently associated with the GAFAM) as opposed to dedicating the extra effort and time needed to explore and navigate the open-source landscape. If European policy-makers are serious about subverting this status quo, they can begin closing the current gap of cross-sector collaboration (Eberhardt et. al., 2022) by requiring public procurement procedures for software solutions to include standards of openness and interoperability among the key selection criteria.

This recommendation builds on some existing precedent in the European context: Estonia, famously a leader in terms of digital governance among EU Member States, has implemented a 'principle of openness' as a guiding value while procuring public-utility software and scaling up IT infrastructures (Chiarelli, Devenyi, Di Giacomo, Dussutour & Zoboli, 2020, p. 5). Under the National Interoperability Framework of the State Information System, as published by the Estonian Ministry of Economic Affairs and Communications in 2011, public institutions and agencies ought to consider open-source alternatives within each public procurement competition and should prioritise questions of interoperability and compliance (Chiarelli et al., 2020, p. 3). Yet including openness as a desirable standard among the many criteria of a public procurement procedure is not the silver bullet: the quantity as well as the quality of engagement with OSS ought to be considered. To develop a genuine open-source digital culture that remains sustainable over time, effort ought to be put into developing new channels for cross-sector collaboration and nurturing creative and open institutional practices. As re-iterated by the Linux Foundation's most recent World of Open Source Europe Spotlight Report (2022), a consumerist approach is not conducive to a healthy open-source culture and ecosystem.

Improving software catalogues for trusted open source software

While some open source projects, such as Linux and Apache, have garnered significant public attention and successfully gather finances from other foundations and companies, many others struggle to gain visibility and "conquer" the public sector, which in turn would lead to increased sustainability. Since open source projects rarely have communications or public affairs teams, it is challenging for them to compete against big tech companies with the aim to be used inside the public or private sector. To address this issue, some governments are taking a proactive role in supporting open source software development. They are acknowledging that despite open source's numerous advantages, it can't compete in a level-playing field with proprietary software in the public contract phase, even if it outperforms it after that stage. Thus proactivity, scouting, and support for open source tools are essential to give them a chance and

encourage open software development. By promoting the use of open source software, governments can help to counter the dominance of big tech companies and produce value for citizens and businesses. Once again, the goal is not to counter big tech "for the sake of it", but to become less dependent on suppliers, have more secure software, control the circulation of data, etc..

One method that has been proposed to give more visibility to open source software within the public sector is the creation of trusted open source catalogues. For example, the French government has developed catalogue.numerique.gouv.fr, which allows all software creators working with the public sector to be listed. Open source software is given a special advantage, as it can be filtered easily.

Another example is the Estonian government repository called Koodivaramu, where open source software solutions developed for the government are made public and freely available.

By supporting open source software catalogues, governments can foster innovation, promote competition, and provide better value for taxpayers. As such, it is important for governments to take an active role in promoting the use of open source software within the public sector.

OSS as a European strategy towards digital sovereignty

Integrating OSS into EU strategic goals

If European decision-makers are serious about the strategic digital autonomy goals they have set out across various recent releases – including the DG Connect's 6 Strategic Priorities for 2020 to 2024, the Europe Fit for the Digital Age framework (European Commission, 2023), and DIGIT's Joinup initiative, their emphasis on open-source software should penetrate much deeper into their core objectives and activities. In addition to forming the core of Europe's digital sovereignty strategy, the openness of digital infrastructures could be formulated as a broader political and social ambition, akin to core principles procedural fairness or institutional transparency. In addition, OSS could also be affiliated with the EU's work on sustainability (and landmark legislation such as the European Green New Deal), since a robust open source ecosystem, its interoperability and reliable maintenance are key to ensuring the resilience and long-term reliability of digital public space in Europe. This could be achieved through multiple practical avenues. Not only should a preference for OSS be explicitly mentioned in DG Connect's long term strategy, the scope and agenda of the Open Source Program Office should also be extended as to be able to support diverse stakeholders who are essential to a healthy open source ecosystem. Open source principles and processes should also inform other key programmes and domains of action, especially when it comes to continent-wide innovation policy and support for research and development.

Specifically, open source software can become a key tool of straightening European digital sovereignty if its objectives are integrated into foundational EU programmes, and thus receives the attention, legal and technical support, as well as the funding options which are associated with core EU strategic objectives. For one, open-source software principles and practices could be more closely affiliated with the EU's existing open science principle. In terms of funding, innovative OSS solutions could be considered

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for new Horizon Europe grant applications, and open source principles could be further emphasised within the New Generation Internet project. In terms of legal support, on the other hand, the proposals presented within the Interoperable Europe Act sketch a framework of cooperation between EU Member States and EU Institutions to secure cross-border exchange of data and agree on shared digital solutions, such as open-source software, guidelines and frameworks. In addition, the proposals also anticipate incentives for innovation in the public sector as well as support for 'GovTech' projects developed through public-private partnerships (European Commission, 2022a). The Interoperable Europe Act provides essential legal backing to a thriving OSS ecosystem, however, its non-binding nature might not be sufficient to ensure an efficient implementation. This report recommends its provisions to be adopted without delay, in particular the introduction of the mandatory cooperation framework and the mandatory interoperability assessments.

Scaling up the Sovereign Tech Fund at transnational, national and regional levels

The Sovereign Tech Fund serves as an example for supporting open-source software projects in the public sector. To foster a diverse set of active communities working on a variety of software, open source should be supported at all levels of organisations and governments. Financing open source software in the same way as the Sovereign Tech Fund, the European Union could support the maintenance and development of tools useful for its institutions, member states, the nonprofit sector, and even for-profit companies.

As open source is inherently global, but its usage is mostly local, a particular attention should be brought to who distributes grants and support to open source projects. The establishment of grant distribution rights to national and regional governments might be interesting, as the European Commission is rarely the final user of the software and may not be aware of specific needs. However, this should be balanced with a holistic supranational view. The best method to reach the maximum information symmetry when providing grants and supporting open source software projects might be to give the rights to distribute funding at the European, national and local levels. They would all have specific scopes of action: the European level focusing more on fundamental technologies that benefit everyone (such as financing programming languages), national level institutions focusing on industries and going in-line with smart specialisation initiatives (for example supporting open source libraries that allow to manage specific industry supply chains), and local governments might decide to mostly aim at supporting open source projects that people use day-to-day (citizen participation platforms, local transport management systems, etc.) . By providing these grants, neither one of the levels should ignore the importance of communities for the sustainability of open source software. Short-term grants allow to hire developers and advance more rapidly, but without a long-term community commitment, open source projects have little future.

A similar approach was taken by the European Union with EU FOSSA 2. Its goal was to raise awareness about the security of open source software. This mechanism could be reiterated, once again at the European level, to increase its commitment to

maintaining open source libraries. Rather than imposing a direction on concrete projects and outputs, the European funding schemes to support the maintenance of open source solutions should rather focus on the core outcome for European and global public sectors – the maintenance of a diverse range of useful open source libraries.

Currently, the Next Generation Internet initiative at the European Union is leading the research and financing effort for open source. As stated in the Declaration of the French presidency on a European initiative on digital commons, "the initiative would build on existing programs and initiatives that have proved efficient like the Next Generation Internet to fund commons and open-source technological components on strategic segments, both at the European and at the national level" (Ministry for Europe and Foreign Affairs & State secretariat for the digital transition and electronic communications, 2022, February 7, p. 1). Even though the funding is higher than the one at the Sovereign Tech Fund's disposal, it is distributed more sporadically, lacks a strategic aspect and advisory. It is also operating on a one-shot funding basis, which is rather poorly fit for supporting the long term sustainability of strategic open source projects. As concluded above, a more ideologically holistic and practically decentralised continuous approach, such as the one suggested by the Sovereign Tech Fund is necessary to truly support strategic digital commons.

7.   Concluding remarks

The significant risks posed by non-European proprietary technologies have already been identified by the Commission; however, they should be accorded an equivalent level of importance to issues such as rare earth sourcing, data protection, and other significant threats to sovereignty. Open source can serve as a solution that not only strengthens the Union's sovereignty but also fuels innovation and creates an alternative ecosystem of collaboration and efficiency. As the European Union swiftly progresses in regulating Big Tech through the Digital Services Act and the Digital Markets Act, support for the development of open source projects should be a concurrent effort, ensuring that the European approach truly represents an alternative path. This necessitates a genuine shift in the modus operandi for European institutions and companies, ultimately creating a new paradigm. However, for this to become a reality, a more systematic and ambitious approach is required, demanding both financial resources and political will. The European Commission's efforts and attitude towards open source are crucial for gaining momentum in this strategy. Internal policy endeavours should be complemented by concrete support that targets and engages the private sector too. This entails creating better funding mechanisms, improving legal frameworks, software catalogues, and facilitating access to technical resources. Open source could be the European way of digitalization.

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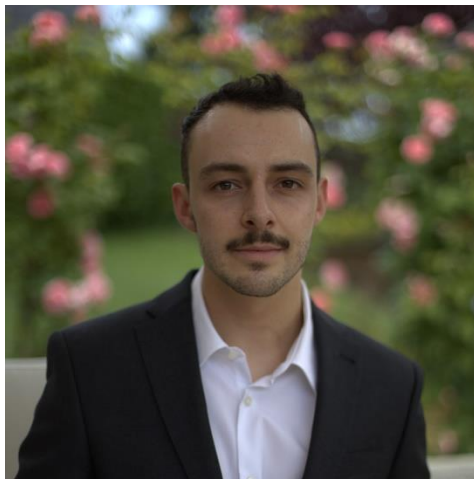
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