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Organizing Public Support for Open Digital Infrastructure

Learnings from the Sovereign Tech Agency

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This Working Paper at a Glance

Open digital infrastructure (ODI) forms the backbone of our interconnected society, yet it faces serious sustainability challenges. This report explores how public support can be organized, using Germany's Sovereign Tech Agency (STA) as a case study. It reflects on both the potential and the tensions of government involvement in decentralized ODI communities. Intermediaries like the STA can help cultivate a sovereign digital commons. In doing so, they can contribute to safeguarding the foundations for a pluralistic, democratic, and open digital society. A sovereign ODI ecosystem will be crucial in breaking the grip of Big Tech, laying the foundations for real alternatives and strengthening those that already exist.

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Summary

Our interconnected world depends on open digital infrastructure (ODI) – the openly accessible digital "roads and bridges" that underpin essential societal services and institutions. Though largely invisible, ODI empowers almost everything from encryption standards that secure communication to programming languages that drive software development and code libraries that facilitate efficient code reuse. As digital commons, ODI is maintained by global, decentral communities that openly share these resources. This openness has made ODI an essential foundation for global digital societies by enabling widespread use beyond specific corporate or state interests.

The openness aspect of ODI is undisputably desirable for society, but openness alone does not ensure sovereign digital commons. Openness allows for unrestricted reuse of ODI, but at the same time it eliminates some monetization opportunities, leaving many communities of ODI maintainers without a sustainable financial basis. The 2021 Log4Shell crisis revealed ODI's vulnerability when hackers exploited a critical security flaw in a widely used logging tool maintained by a few volunteers. For ODI to function as a sovereign digital commons, its contributors must have a stable financial basis to sustain open, secure, and self-determined access for citizens, industry, and governments alike.

Financial support for ODI plays a dual role in its sovereignty: it can enhance the autonomy of the digital commons, but it can also create new dependencies serving primarily corporate or national state interests. Private sector support is often limited and, when existent, aligns with business priorities. Big Tech's dominance in the digital sphere raises critical questions about how ODI can remain a truly open and democratic alternative without structural reliance on major industry players.

However, the challenge in ODI extends beyond concerns about structural dependence on Big Tech: many areas of ODI function as global public goods – foundational, widely shared, and essential to actors across society, from civil society to small and medium enterprises, and to large corporations. Recognizing this public good character reframes the debate beyond market failure or state aid – it points to the role of governments in enabling and stewarding digital commons.

The role of governments in strengthening ODI's sovereignty as a public good through public support remains underexplored. Public funding for ODI is not merely about subsidizing private companies with taxpayer money but about ensuring that ODI serves society as a whole. A more active government role can ensure that ODI is not shaped solely by dominant market forces or left without sustainable funding altogether.

The goal is not an authoritarian, state-controlled model of national sovereignty but an exploration of how governments can support the ethos of a global, decentralized, and community-driven sovereign digital commons. Finding a symbiotic relationship between governments and the ODI commons is essential in a realm dominated by Big Tech corporations.

In this learning report, we discuss the opportunities and challenges for government instruments designed to support ODI and strengthen its sovereignty. Our report focuses on the Sovereign Tech Agency (STA), a German public sector organization established in 2022 to fund ODI with public resources. The report is based on a two-year, independently funded research project, for which we employed qualitative methods, including interviews with STA officials, funded ODI projects, and experts, alongside participatory observation and document analysis.

Our findings show that STA's approach can reinforce ODI's sovereignty as a decentral, global and independent digital commons. Emerging from a bottom-up initiative with firsthand experience in ODI communities, the STA has a deep understanding of their needs and challenges. The STA continually explores new support mechanisms, particularly by commissioning maintenance and development work in ODI.

Our research highlights the STA's impact on maintainers, providing financial stability and recognition while strengthening project autonomy, sustainability, and strategic direction. Crucially, the STA has built trust within communities, with ODI projects perceiving its involvement as aligned with their autonomous decision-making rather than as an imposition of national state interests.

However, public support for ODI's sovereignty also comes with inherent tensions. As an intermediary, the STA must navigate between two different worlds – the German government and the decentralized ODI projects it funds. While government funding introduces bureaucratic requirements, accountability measures, and political authority, ODI projects operate in a more fluid, commons-based, and decentralized manner.

Our report examines how the STA seeks to balance three key tensions: (1) visibility tensions, by bridging between societal value and technical reality, (2) adaptability tensions, by flexibly aligning public funding with the fluid nature of ODI communities, and (3) dependency tensions, by buffering state influence while preserving ODI's autonomy as a commons.

Our study on the STA shows that advancing ODI's sovereignty requires coordinated efforts across multiple actors. Public support institutions like the STA need to establish values, norms and procedures that resonate with the communities they are trying to support. This requires increasing transparency, democratic governance, and community participation rather than the enforcement of rigid top-down structures.

ODI projects and communities continue to struggle with the development of sustainable governance models that align with the principles of a sovereign digital commons. This search is complex and resource-intensive. However, the STA's approach suggests that temporary autonomy boosts through public support can enable ODI projects to invest in long-term, self-reinforcing mechanisms such as community engagement.

Governments have long neglected ODI as a public good, but now is the time to act. While national or supranational funding initiatives are a step in the right direction, a diverse funding landscape is essential for a truly sovereign ecosystem. The more independent funding streams exist, the less vulnerable ODI will be to single points of failure or undue influence. In addition, our study highlights the need for complementary mechanisms – such as tax policies and regulations – to reinforce the decentralized digital commons on a global scale, extending beyond national jurisdictions without constraining sovereignty within a purely national framework.

Furthermore, worker representation, such as labor unions, can play a crucial role in ensuring the sustainability of ODI by fostering dialogue among tech workers and the industry to stabilize the labor conditions necessary for maintaining its sovereignty.

Looking ahead, governments worldwide have an opportunity as well as a responsibility to take a more active role in strengthening ODI's sovereignty. The case of the STA has shown that organizational intermediaries between government and ODI communities can complement and reinforce the foundations of ODI as a sovereign digital commons. ODI exists in a landscape dominated by monopolistic Big Tech and increasingly techno-authoritarian state regimes.

Public support can safeguard the conditions for a pluralistic, democratic, and self-determined digital future. It is essential to ensure that digital infrastructure remains secure, open, and collectively governed in order to prevent control by a few dominant actors. A sovereign ODI ecosystem will be crucial in breaking the grip of Big Tech, laying the foundations for real alternatives, and strengthening those already existing.

1 Open Digital Infrastructure

1.1 Relevance

What is Open Digital Infrastructure?

ODI refers to the foundational and openly accessible digital technologies that make an important contribution to society. Infrastructure in this context means that these technologies serve as input resources into a broad range of downstream productive activities, e.g., programming languages used for software development (Frischmann 2012). We can think of ODI as digital "roads and bridges" that underpin most activities in today's digitally-mediated world.

ODI functions as a digital commons, collaboratively maintained by communities of diverse actors and freely accessible for everyone to use and build upon. Examples of ODI are varied and include databases such as MariaDB, programming languages such as Rust, security tools such as OpenSSL, encryption standards such as PGP, or file transfer libraries such as libcurl.

These foundational digital technologies form an interdependent and complex ecosystem. Some of these infrastructures have become global standards, while others serve niche but essential functions. Although rarely noticed, such technologies underpin everyday digital activities, from sending emails to browsing the web and making online payments.

The "open" in ODI means that the technologies are freely available for use, modification and development without licensing costs. The openness of digital infrastructure has contributed enormously to the rapid development of the digital world as we know it. For example, a company developing a secure messaging app does not need to build its own encryption algorithm from scratch but can rely on established protocols like TLS and available library implementations such as OpenSSL or Libre SSL to ensure security and reliability.

The value of Open Digital Infrastructure

The value of ODI is immense, yet often overlooked. The economic value of open-source software, most of which qualifies as ODI, is estimated at 8.8 trillion Dollar in use value (Hoffmann/Nagle/Zhou 2024), nearly double Germany's GDP in 2023. Open-source software powers 97 percent of commercial code and makes up 70 percent of all code (Blackduck 2025). The practice of open sharing is more widely known as open-source soft-

ware. Open-source software qualifies as ODI when it serves as a foundational component rather than a user-facing application such as web browsers like Firefox.

From start-ups to global corporations, companies rely on ODI for innovation, scalability, and efficiency. Start-ups leverage ODI to drive new business ideas (Wright/Nagle/Greenstein 2024). ODI technologies like RubyGems, a package manager for the Ruby programming language, help firms such as Shopify, SoundCloud or Airbnb to access collections of prewritten code for efficient programming. Studies suggest a 10 percent increase in open-source contributions could lead to 600+ new tech start-ups in the EU (Blind et al. 2021). Even more traditional industries, like automotive manufacturing, depend on ODI for production and embedded car systems.

For governments, ODI is an important public good because it underpins economic transactions, societal exchange, and security – core public values that require government support. ODI reduces dependence on the dominant tech corporations and contributes to the fostering of overall societal welfare (Blind et al. 2021). For example, CERN uses OpenStack, a vendor-independent cloud system, to support thousands of researchers. The U.S. Cybersecurity and Infrastructure Security Agency emphasizes the need to protect ODI, as it underpins critical systems (Cyber Safety Review Board 2022).

ODI has even broader yet understated social value. Shared infrastructure resources enhance downstream social exchange such as education or communication, thereby subtly improving societal welfare (Frischmann 2012). For instance, the Python programming language fosters global coding education, while free VPN protocols like WireGuard protect journalists and activists by ensuring access to uncensored information in repressive regimes.

1.2 Sustainability Challenges

ODI faces serious sustainability challenges. As a digital commons, ODI is openly shared, communally owned and maintained by a decentralized network of various contributors collaborating on platforms like GitHub or community forums. Like other commons, ODI is vulnerable to collective action problems – issues arising when shared resources depend on contributions but lack clear incentives for maintenance. Nobel Prize winner Elinor Ostrom (1990) identified two key interdependent challenges for commons: demand-side problems (overuse, extraction, or appropriation through use) and supply-side problems (insufficient contributions).

Demand-side problems

ODI's openness drives widespread societal value across sectors, but high demand without matching contributions puts a strain on its sustainability. Although software is reusable, ODI is not a "build once, use forever" system.

Like roads that deteriorate with heavy traffic demand, ODI accumulates technical debt, requiring continuous updates to stay secure and compatible with evolving technologies (Eghbal 2020). Without sustained financial support, ODI risks becoming defunct as increased demand brings heavier workloads, more bug reports, and a need for more maintenance. A system used by 100 million users places far greater strain on maintainers than one with only 100 users (e.g., for community management or bug fix requests). As Nadia Eghbal (2016, p. 4) highlighted in her report on digital infrastructure, demand affects supply:

> "Our modern society – everything from hospitals to stock markets to newspapers to social media – runs on software. But take a closer look, and you'll find that the tools we use to build software [ODI] are buckling under demand."

Another demand-side challenge is the private sector's dominance in shaping ODI's development, especially Big Tech. While corporate contributions are crucial, they often prioritize business needs over public interests. For example, corporate donors often secure board seats in nonprofit open-source foundations like OpenStack, influencing decisions in ways that promote a company's particular interests (Schrape 2015).

Supply-side problems

Supply-side problems refer to the difficulty of sustaining a shared digital commons resource when contributions are insufficient to meet demand. In the case of ODI, various actors contribute, but this supply remains highly uneven and structurally fragile.

ODI lacks both market-driven revenue streams and government-backed funding. Due to its openness, ODI cannot generate revenue to compensate for supply, nor would this be desirable. Imposing price discrimination on ODI's foundational layers would undermine societal welfare (Frischmann 2012). However, while openness is essential, someone still needs to bear the costs of supply.

While private corporations contribute to ODI, their support is often selective. Private sector actors usually only fund open-source projects when

they see a business opportunity, such as Intel supporting Linux Kernel or Meta backing React Native. However, deeper infrastructure layers, such as libraries or logging protocols, as well as higher levels of infrastructure that are closer to the end-user but also lack monetization potential, such as the GNOME desktop environment included in GNOME-based Linux distributions like Debian or Ubuntu, are still neglected as "contribution deserts" (O'Neil et al. 2022).

For governments, ODI operates beyond national jurisdictions on a global scale, unlike tax-funded roads. As a result, government support is often limited to specific use cases, such as adopting the Linux operating system in public administration, rather than investing in ODI itself.

To mend this structural fragility of supply in the production of global digital commons, ODI often relies on community-driven efforts, volunteer contributions, and nonprofit initiatives. Many critical ODI projects depend on a handful of unpaid maintainers working with minimal resources (Eghbal 2016). As ODI projects grow, maintainers take on more responsibilities, but without any increase in financial support (Geiger/Howard/Irani 2021).

In 2021, the Log4Shell crisis exposed this reality when hackers exploited a security gap in a widely used logging tool (Log4j). As a result of this, businesses and governments faced chaos while attempting to close the security gap and prevent potential attacks. Germany's Federal Office for Information Security declared the highest-level of IT threat warning. When the crisis struck, the tool was maintained by just a handful of volunteers, relying on unstable funding.

Another challenge is that many ODI contributors lack formal labor protection, job security, or bargaining power, leaving them vulnerable to exploitation and corporate influence. Without unions or advocacy groups, they struggle for fair compensation and governance rights.

While ODI enables exceptional shared value beyond traditional state or market approaches, it also brings structural vulnerabilities. Relying on unpaid labor worsens participation inequalities (O'Neil/Broca 2021). ODI contributors are predominantly affluent white men from Europe and the U.S., as they are more likely to be able to work for free in their spare time (Trinkenreich et al. 2022). Ultimately, attracting more diverse contributors is essential to foster innovation and inclusivity (Linåker/Link/Lumbard 2024).

1.3 Sovereignty and the Need for Public Support

The sustainability challenges of ODI raise fundamental questions about its sovereignty. Broadly speaking, digital sovereignty refers to the ability of individuals and institutions to fill their roles in the digital world in an independent, self-determined and secure manner (Goldacker 2017).

However, the concept of digital sovereignty remains ambiguous, encompassing a range of interpretations – from state-centered security concerns and efforts to reduce technological dependencies (e.g., adopting open-source software in public administration) to albeit less frequent questions of democratic empowerment (Lambach/Oppermann 2023). Many policy discussions on sovereignty focus on cases of platform governance and semiconductor production, often emphasizing state authority (Lambach/Monsees 2025).

In the case of ODI as a digital commons, sovereignty must go beyond a state-centric, authoritarian notion and instead align with ODI's commons-based, global, and decentralized nature. A sovereign digital commons can only thrive if it upholds the Internet's original promise – an interconnected network for a free society, built on openness, solidarity, and the right to participation (Geuter 2014).

We propose viewing ODI as a sovereign digital commons that is inherently relational, existing in a constant tension between autonomy and dependency (Hardt/Negri 2004). This relational perspective acknowledges that ODI projects depend on various forms of external support, including contributions from companies and governments.

For instance, government involvement in safeguarding ODI walks a fine line between exercising its privileged authority on the one hand and granting autonomy to the decentralized nature of ODI on the other. Any external effort to safeguard sovereignty in ODI must ensure that its infrastructure remains open, democratic, and independent – free from domination by either market forces or state control.

In response to ODI's sustainability challenges, the Sovereign Tech Agency (STA) was established in May 2022 with the goal of safeguarding ODI's sovereignty by providing public support. The STA is a German federal agency that receives backing from the German Federal Ministry for Economic Affairs. The STA's mission is to "support the development, improvement, and maintenance of open digital infrastructure" (Sovereign Tech Agency 2025a). The STA provides public funding for critical yet often overlooked ODI maintenance and development work. Within two years, the STA has become a key actor in the ODI and policy landscape, actively fostering dialogue around ODI-related challenges and solutions.

So far, the political and academic debate on support for digital commons has focused primarily on application-related open-source software (e.g., Linux operating systems in the workplace). Despite ODI's significant economic and social impact, little attention has been given to how public support for its sustainability could be organized.

2 Research Design and Methods

The aim of this learning report is to build knowledge on how to organize public support for ODI, using the STA as an example. The report does not seek to formally evaluate the work of the STA, but to identify challenges, solutions and recommendations for action for various actors involved in the ODI ecosystem, such as policymakers, practitioners, industry leaders and academics.

This learning report is based on an 18-month research project on the STA conducted between June 2023 and November 2024. The design and data collection for this study were primarily carried out by René Lührsen as part of his doctoral thesis at Leuphana University Lüneburg. René's work was funded by a doctoral scholarship from the Hans Böckler Foundation.

In 2021, discussions about what was then called the "Digital Infrastructure Fund" emerged on Twitter/X. Building on these emerging discussions, René proposed an independently funded research project to the bottom-up initiative that would later become the STA. Shortly afterwards, Thomas Gegenhuber and Maximilian Heimstädt joined the research project as collaborators.

The study followed a qualitative research approach, combining interviews, participatory observation, and document analysis. In total, René Lührsen conducted 38 semi-structured interviews: 12 with STA employees, 18 with representatives of funded ODI projects, and 8 with open-source policy experts, independent developers, or civic tech community members. These interviews were supplemented by participatory observation at public events (e.g., re:publica conference, STA-organized community meetings) and at the Berlin office of the STA. Finally, publicly accessible documents were also evaluated for the study, including social media posts, websites, and press articles.

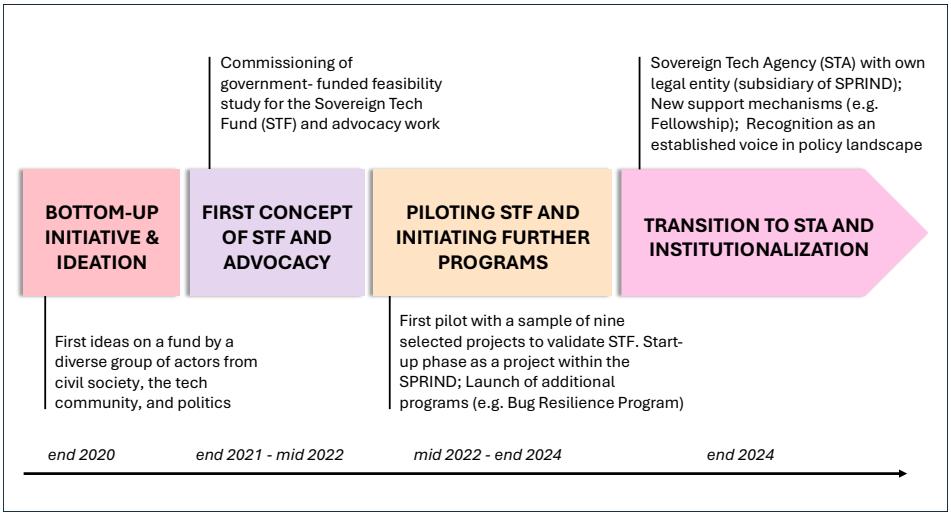
3 The Sovereign Tech Agency: From Initiative to Institution

The development of the STA illustrates how public support for ODI has taken shape, from a bottom-up initiative to a government-backed institution.

3.1 History

The case of the STA illustrates how a bottom-up initiative can successfully mobilize public support to establish a government-backed organization for the support of ODI. This section traces the STA's evolution from a nascent initiative into a government institution (see Figure 1 for an overview).

Figure 1: Timeline of the Sovereign Tech Agency



Source: Authors' illustration

Phase 1: Bottom-up initiative and ideation

By late 2020, a diverse group of actors from civil society, the tech community, and politics began collaborating on initial ideas for to establish a public fund to support ODI – the Sovereign Tech Fund (STF). The group included Adriana Groh and Fiona Krakenbürger, who brought along ex-

tensive experience from organizations such as the Prototype Fund, the Open Knowledge Foundation Germany, and the US-based Open Technology Fund.

Together, the group combined policy expertise with practical technical insights gained from working at the intersection of civil society and government. Other members of this early group of advocates were the independent researcher Katharina Meyer, technology policy advocate Felix Reda, and open-source technologist Tara Tarakiyee. Together, the group of advocates mobilized their networks to build political and public momentum for the nascent initiative.

One of the group's main activities during this phase was to identify gaps in the existing funding landscape. They pointed out that while the German Prototype Fund focused on open-source innovation and the US-based Open Technology Fund supported politically aligned projects like free speech tools, neither addressed the ongoing maintenance of foundational ODI. The recognition that essential ODI projects faced precarious conditions emerged simultaneously in practitioner research, such as Eghbal's "Roads and Bridges" (2016) and Lindinger, Kloiber and Meyer's "Roadwork Ahead" (2020).

High-profile crises, such as the Heartbleed Bug (2014, cf. heartbleed.com) and the Log4j vulnerability (2021), further emphasized these potential negative consequences of a funding gap for ODI. Building on this window of opportunity, the group behind the nascent STF demonstrated that essential ODI projects were operating under precarious conditions.

Phase 2: First concept of the Sovereign Tech Fund and advocacy

Building on the mobilizing efforts of the nascent group behind the Sovereign Tech Fund (STF), they were commissioned with a feasibility study in 2021, funded by the German Federal Ministry for Economic Affairs and Climate Action (BMWK) and the Federal Agency for Disruptive Innovation (SPRIND) (cf. Groh et al. 2021). The Open Knowledge Foundation Germany served as the legal and organizational host for the study. The study brought together a diverse group of experts, including prominent open-source developers and security researchers, and incorporated interviews and workshops with key stakeholders.

The STF's successful advocacy work was probably shaped by several interrelated factors. The initiative emerged from a well-established digital civil society, closely connected to tech communities and policy experts, where advocates actively pushed for greater public support. Broader po-

litical recognition across those involved in ODI's role in digital sovereignty created a more receptive policy environment.

Notably, the STF received cross-party support. Initially launched under the CDU-led BMWK, it continued seamlessly after the SPD-Green-FDP coalition took office in December 2021. Cybersecurity crises such as the Log4j vulnerability also heightened awareness of the risks posed by an underfunded digital infrastructure.

Phase 3: Piloting of the Sovereign Tech Fund and initiating further programs

In May 2022, the German Bundestag allocated approximately 2.55 million Euro to launch the STF as a project within SPRIND (Federal Agency for Disruptive Innovation). According to the STF, this structure allowed it to "hit the ground running" and bypass bureaucratic hurdles, leveraging SPRIND's administrative resources while focusing on its core mission. The fund began its work in September 2022.

In November 2022, the STF launched a pilot round with nine funded ODI projects to showcase the ecosystem's diversity and gather key insights. Following an evaluation, the STF publicly shared its findings before launching its first official funding round in mid-2023 (cf. Groh et al. 2023). In 2023, the STF expanded its support programs, introducing initiatives such as the Bug Resilience Program to address vulnerabilities in critical ODI projects.

By 2023, the German government had increased funding to 11.5 million Euro, and by 2024, this rose to 19.5 million Euro, enabling the STF to expand its staff and programs. While these budgets mark a strong start with increasing tendency, they remain modest compared to other digital initiatives. For context, the German Federal State allocated 198 million Euro for Microsoft licenses, 220 million euro for the Corona-Warn-App, and 700 million Euro for 6G research.

Phase 4: Transition to the Sovereign Tech Agency and institutionalization

In November 2024, the STF transitioned into the STA, becoming an independent subsidiary of SPRIND. According to the team, their mission "has grown to be more than a fund". This shift granted the STA greater autonomy, including its own in-house legal counsel, while maintaining accountability to the relevant federal ministry. As a federal agency, the STA oper-

ates with administrative independence, enabling it to carry out specialized tasks without direct political oversight while aligning with broader government policies. The new legal status has allowed the STA to seek funding beyond BMWK.

By the end of 2024, the STA's team comprised around 10 full-time staff members, including new hires such as a communications manager, a legal professional, and program leads with extensive expertise in technology. The STA's mission states:

> "The Sovereign Tech Agency supports the development, improvement, and maintenance of open digital infrastructure. Our goal is to sustainably strengthen the open source ecosystem. We focus on security, resilience, technological diversity, and the people behind the code." (Sovereign Tech Agency 2025b)

The STA's evolution illustrates how collaboration between diverse groups of actors from civil society, policy and tech communities can lead to new federal agencies that address critical support gaps. It highlights Germany's capacity to turn bottom-up initiatives into state-backed institutions. Several factors may explain why Germany offered a fertile ground for the STA.

First, as one of the world's largest economies, it has both the capacity and responsibility to invest in global public goods like ODI. For the BMWK, supporting the STF aligned with its broader goals of fostering innovation, strengthening competition, and investing in digital infrastructure – both within Germany and beyond.

Second, Germany attempts to promote European values of openness and digital sovereignty. Third, Germany's strong tradition of civil society engagement in tech provided a foundation for the STA's emergence. The STF team itself exemplified these connections, with strong international ties to initiatives like the Open Technology Fund.

3.2 Direct and Indirect Forms of Support

With its transition from a bottom-up initiative to an established institution, the STA has developed a range of support mechanisms aimed at strengthening ODI's sovereignty. The STA currently provides three direct programs to support ODI (Table 1). Each program leverages financial resources to address different structural challenges in ODI. The STA's direct forms of support are intended to complement existing funding mechanisms for ODI (see Table 3 in the appendix for a detailed overview).

Table 1: Overview of the direct support programs of the Sovereign Tech Agency

Support program	Status	Mechanism	Governance of ODI projects
Sovereign Tech Fund	Primary support program, investing in 30+ ODI projects since mid-2023	Strategic investments in development, improvement, and maintenance work, directly assigned to maintainers	Governed via service agreements with milestone-based tracking and invoicing
Sovereign Tech Resilience	Complementary program (formerly Bug Resilience), launched mid-2023	Supports ODI projects through code audits, bug fixes, bounties, and external service contracts	Commissioning third party vendors through work orders to provide services to ODI projects
Sovereign Tech Fellowship	Latest program, launched in late 2024, currently in pilot phase	Provides direct funding to individual maintainers for various activities	Operates via freelance service contracts and employment agreements at the Sovereign Tech Agency

Note: Sovereign Tech Challenges are not included here
Source: Author's illustration

An essential aspect of how the STA engages with and selects ODI projects for its direct support mechanisms is its dual approach: an active scouting strategy (pull) and an open application process (push). Both mechanisms rely on community engagement through dialogue to connect with the people behind the projects and understand their needs. While the application process may favor projects with existing networks and communication capacities, proactive scouting can offer a corrective by reaching out to less visible yet equally critical initiatives.

During its early phase the STA relied more on scouting, proactively reaching out to projects identified as relevant through research, expert input, and publicly available surveys. While proactive scouting is re-

source-intensive and can be prone to selection bias, it enabled the STA to unearth critical infrastructure projects that may not have applied independently.

The application process, by contrast, depends on the STA's visibility within the community, which was limited at the outset but has steadily increased, leading to a growing number of unsolicited applications. Today, scouting has evolved into a more strategic instrument, helping the STA identify structurally underrepresented areas aligning with their notion of public interest.

Sovereign Tech Fund

The *Fund* is the STA's main funding instrument to invest strategically in ODI projects' maintenance and development work. Unlike donations or grants, the STF's investment is structured through service agreements with jointly defined milestones and deliverables. These agreements aim to ensure that the commissioned work directly contributes to sustaining ODI in line with the STA's public interest objectives.

The *Fund* supports a wide range of actors, including non-profits, for-profits, and even individual or community maintainers, unlike most non-profit foundations that typically require legal non-profit status.

ODI projects can either apply proactively online or they may be approached directly by the STA. After an initial review, the STA works with project maintainers to refine objectives and milestones, ensuring alignment with its funding criteria: *prevalence* assesses how widely the technology is used, *relevance* examines its societal impact, and *vulnerability* evaluates funding gaps or structural challenges (cf. www.sovereign.tech/programs/fund). Funded ODI projects typically receive between 200,000 Euro and 1 million Euro, with durations ranging from six months to over two years. The minimum amount is 50,000 Euro and there is no upper funding limit.

One example of an STF-funded ODI project is the Yocto Project, which develops tools for Linux-based embedded and IoT software. The STA allocated it 759,000 Euro to improve workflow, quality, and security, including automated testing of code patches. Another example is GNOME, a widely used open-source software desktop environment, which received 1 million Euro to modernize the platform, enhance tooling, and improve accessibility, such as overhauling the accessibility stack to ensure compatibility with modern technologies.

Sovereign Tech Resilience

The *Resilience* program focuses on proactively identifying and addressing vulnerabilities in critical codebases. Unlike direct ODI project funding, here, the STA commissions external partners to conduct audits or improve documentation in collaboration with ODI projects. For example, Neighbourhoodie Software provides documentation support and direct code contributions, the Open Source Technology Improvement Fund conducts code audits, and YesWeHack facilitates bug discovery through reward-based "bug bounty" programs. ODI projects can apply specifically for Resilience services or combine them with support from the *Fund*, depending on their needs.

Sovereign Tech Fellowship

The *Fellowship* program provides direct support to individual maintainers rather than collective projects. Recognizing that many maintainers are balancing multiple projects and diverse employment arrangements, this mechanism offers freelance contracts or employment within the STA team. Applicants must contribute to at least three open-source projects and be the maintainer of at least one. The program is designed for flexibility, accommodating the realities of maintainers' work and life situations. As the newest initiative, the program is still in its pilot phase at the time of writing.

Indirect support through advocacy

Beyond its direct funding programs, the STA's advocacy work serves as a crucial pillar of indirect support for ODI. According to the STA team, advocacy is an "implicit core task" for them. The STA's advocacy work aims to shape public discourse and awareness around ODI.

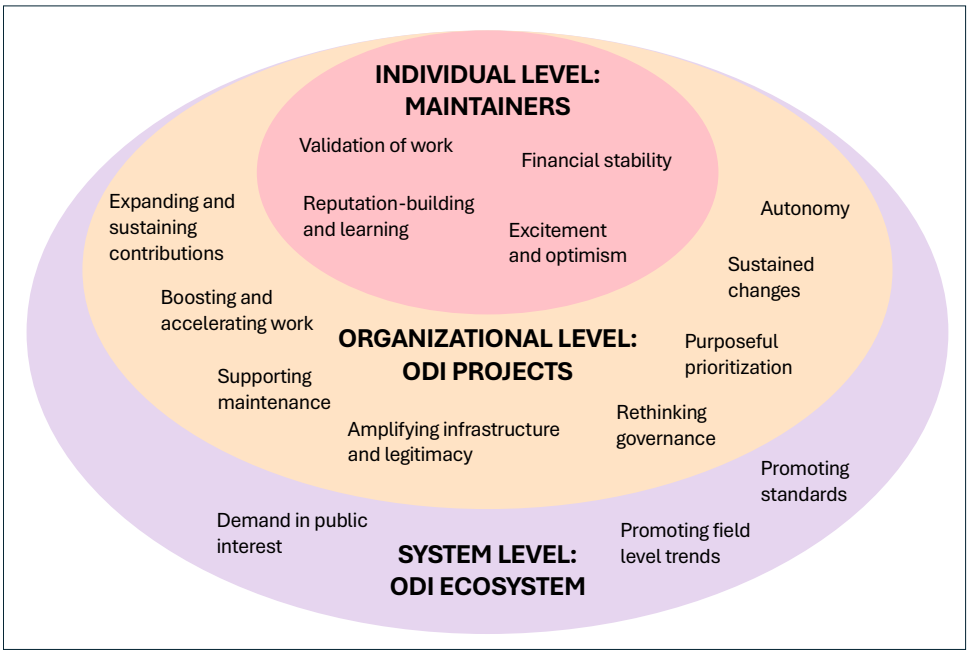
Through participation in public forums across civil society, industry, and government, the STA actively raises awareness of ODI's challenges and it's nature as a global public good. The STA participates in civil society events such as Netzpolitischer Abend and re:publica, industry events such as the SAP Podcast, and high-level public sector forums like the EU OSS Summit, the German Digital Summit, or the United Nations OSPOs for Good conference in New York. Participation in these events fosters a broader understanding of ODI's significance, potentially mobilizing additional support from other actors.

The STA's growing influence as a key advocate is further reflected in its recent invitation as an expert to a parliamentary hearing on open-source software (cf. Deutscher Bundestag 2024a). Such recognition underscores its evolving role as an advocate for ODI at the policy level, demonstrating how indirect support through advocacy could drive long-term structural change.

3.3 Impact on Open Digital Infrastructure

As the STA's support mechanisms take shape, their effects on ODI are becoming increasingly visible. This section outlines key impact patterns based on qualitative interviews with funded projects. While not a comprehensive evaluation, the insights presented reflect central observations from our research. We illustrate key observations at three levels: individual maintainers, specific ODI projects, and the broader ecosystem (Figure 2).

Figure 2: Impact on three levels in Open Digital Infrastructure



Source: Authors' illustration

Individual level: Maintainers

Our findings suggest four key effects at the individual level. First, monetary support not only funds work but also affirms its value, increasing recognition among peers, family, and the broader community. Many maintainers said how the STA's support had validated their contributions, making their efforts more respected:

> "My partner used to say, 'You could earn more in consulting than in open source.' Now, those comments have stopped. [...] People don't respect unpaid work. The STA's funding changed that."

Second, the STA's funding provides temporary stability, allowing maintainers to plan and sustain their work. Financial insecurity often prevents maintainers from fully focusing on ODI. A community manager of an ODI project emphasized:

> "I hadn't realized it before, but the people writing this software aren't just coding for fun. They have homes, families, and need continuity. Stability matters."

Third, the STA's funding also served as a catalyst for reputation-building and learning. A key intrinsic motivation for participating in open-source projects is the opportunity to build one's professional reputation and gain valuable learning experiences, particularly for younger developers (cf. Von Krogh et al. 2012). STA-funded contributors gained career advancement, with some securing high-profile jobs post-funding. As one project coordinator put it: "A developer from our team landed a prestigious role after the STA-funded project. Their experience in trending topics was key."

Fourth, many contributors expressed genuine enthusiasm about the STA's role in reshaping ODI's recognition and sustainability. The STA's existence symbolizes a shift toward valuing ODI, as expressed in the following two quotes from ODI projects:

> "It really gives us hope that this will change something."

> "I was super curious when the STA got in touch with us and the government showed interest for the first time."

Organizational level: ODI projects

Our qualitative data highlights several organizational level effects of STA funding. First, STA funding has played a role in expanding and sustaining contributions to ODI. Many projects struggle to onboard contributors who

will remain engaged long-term. STA funding has helped some projects bring in new contributors and sustain existing ones:

> "We hired our first full-time developer – only possible by combining STA funding with another major sponsor. It allowed us to keep part-time contributors and upgrade one to full-time."

The STA also supports community-building and long-term contributor engagement, as reflected in this project's experience:

> "Our goal was to bring people into the community and keep them engaged beyond short-term funding. We created a foundation for sustainable maintenance and vision-building."

Second, STA funding boosted and accelerated work, enabling ODI projects to increase output by allowing contributors to dedicate more time to neglected tasks like bug fixes, documentation, and new features. For instance, the maintainer of the Log4j project illustrated this through GitHub activity (see Figure 4 in the appendix). ODI projects typically see strong early engagement, which declines over time, leaving maintenance underfunded. After the Log4Shell crisis (2021), contributions surged temporarily but later tapered off. With STA funding (2023–2024), commits increased again, allowing the team to improve compatibility, documentation, and essential maintenance.

The STA's support not only sped up progress but significantly shortened development timelines. One project noted: "Without STF funding, our main developer would have needed four or five years to reach the level he's at now."

Third, STA funding not only enabled more work but also prioritized maintenance, a task often overlooked under typical conditions. Bug fixes, code robustness, and documentation improvements are rarely funded. One ODI project noted: "Continuous funding for maintenance just doesn't happen, and that remains a significant problem."

Even projects with private-sector sponsorships struggle to allocate time for maintenance. Another project shared:

> "Giving the developers three months to clean up the tracker, review issues, and handle these tasks was great. It was much better than working with companies, which focus on short-term features rather than long-term infrastructure."

Fourth, for emerging ODI projects, the STA's support offered foundational funding that ensured survival and early traction. While STA primarily funds maintenance in mature projects, in a very few cases, more early-stage

investment was crucial to turn potential into tangible progress. One project reflected:

> "The funding allowed us to reach a level where we became interesting. Without the STA, we would have needed a Plan B, but I don't know what that would have been."

ODI projects grow into substantial infrastructure through early adopters who validate their relevance, refine their functionality, and sustain engagement. The STA's support not only funded development but also added legitimacy, helping projects attract users and build trust within the community. Two projects noted:

> "STA funding gave us legitimacy. Our first major user partly based their decision on the fact that we had received STA support."

> "Look, there's a government organization supporting us – you might consider doing the same."

Fifth, the STA's funding has prompted several ODI projects to revisit their internal governance – for example, by formalizing decision-making processes, redistributing responsibilities, or reflecting on dependencies on other actors. While not a substitute for sustainable governance, it has prompted reflections on professionalization, funding stability, and alignment with public-interest goals:

> "We started actively addressing our governance structure. The biggest challenge is that no one in our community can handle governance and finances full-time. This should be properly compensated. Without the STA, this process would have taken much longer."

Another project described how STA funding brought long-standing governance issues to the surface:

> "Our structure has been a latent issue for years. The STA forced us to confront it. We may need to reorganize everything, or it could resolve quickly – I don't know. But now it's clear what works and what doesn't."

Sixth, STA funding has increased ODI projects' autonomy, enabling them to make more independent decisions and allocate resources to their priorities. While it does not eliminate dependencies (see Chapter 4.3), many projects reported feeling more empowered to pursue long-term goals that they see as meaningful. One project noted:

> "With the STA, we can create positions, bring people onto projects, and focus on long-term goals that we see as meaningful – things that were much harder with only voluntary contributions."

However, this autonomy is time-limited. STA funding typically lasts between a few months and two years, after which projects must secure new funding to sustain their work. As one project shared:

> "We have STF funding to keep everyone on, but that means the entire STF budget is spent. By the end of 2024, I need to secure 300,000 Euro a year to keep going."

Seventh, the STA's structured milestone planning and goal-setting helped ODI projects think strategically and focus on long-term impact. While some projects already had clear priorities, many benefited from a more deliberate approach to planning, particularly those caught in day-to-day reactive work. One maintainer explained:

> "Planning milestones upfront clarified that time spent was valuable. Without it, the default might be focusing on the latest issues or pull requests instead of tackling substantial tasks."

Beyond immediate funding, this prioritization sustained momentum and mobilized additional resources:

> "Certain issues that seemed too big to tackle before funding are now on the agenda and will continue beyond the STA's support. Creating momentum in this direction also mobilizes volunteer resources in the medium term."

Eighth, the STA's funding often led to sustained changes beyond temporary support, strengthening projects for the future. Many reported that investments made during the funding period laid a stronger foundation for long-term maintenance and easier future updates. One maintainer reflected:

> "I believe we now have a solid foundation to maintain many things in the long run. Much of it will remain sustainable – especially the documentation. As long as we keep up with updates, it will continue to work. That's only possible now because we put in so much effort upfront."

System level: ODI ecosystem

While our qualitative approach does not aim to capture all ecosystem-wide effects, feedback from ODI projects highlights three notable contributions to the broader infrastructure.

First, the STA has created public demand that complements the market-driven demand of the private sector. Private funding prioritizes product-aligned features, overlooking broader public-interest needs. Public

support can fill these gaps and drive progress in underfunded but socially valuable areas. As one interviewee noted:

> "Somebody has to be the first to try something out, and that's best done with public money. Without the STF, developing this feature would have taken another three, four, five years."

Potentially, public funding also creates positive spillover effects to other socially desirable areas such as community building, especially in areas with little private investment, such as accessibility (e.g., making software more easily usable and compatible). One maintainer explained:

> "Accessibility has seen almost no investment in the last 15 years. Companies manage it, but it's not critical. The STA's support enabled community building and learning in this field – this wouldn't have happened otherwise."

Public demand, as created by the STA, is not only about funding what's missing – it also involves making strategic and sometimes difficult decisions when there are multiple viable alternatives. Funding decisions can become more complex when multiple alternatives exist. The STA has supported parallel interoperable implementations within the same ecosystem, such as Logback and Log4j (logging) or SequoiaPGP and OpenPGP (encryption). However, not all alternatives can receive equal funding, making transparency in decision-making essential.

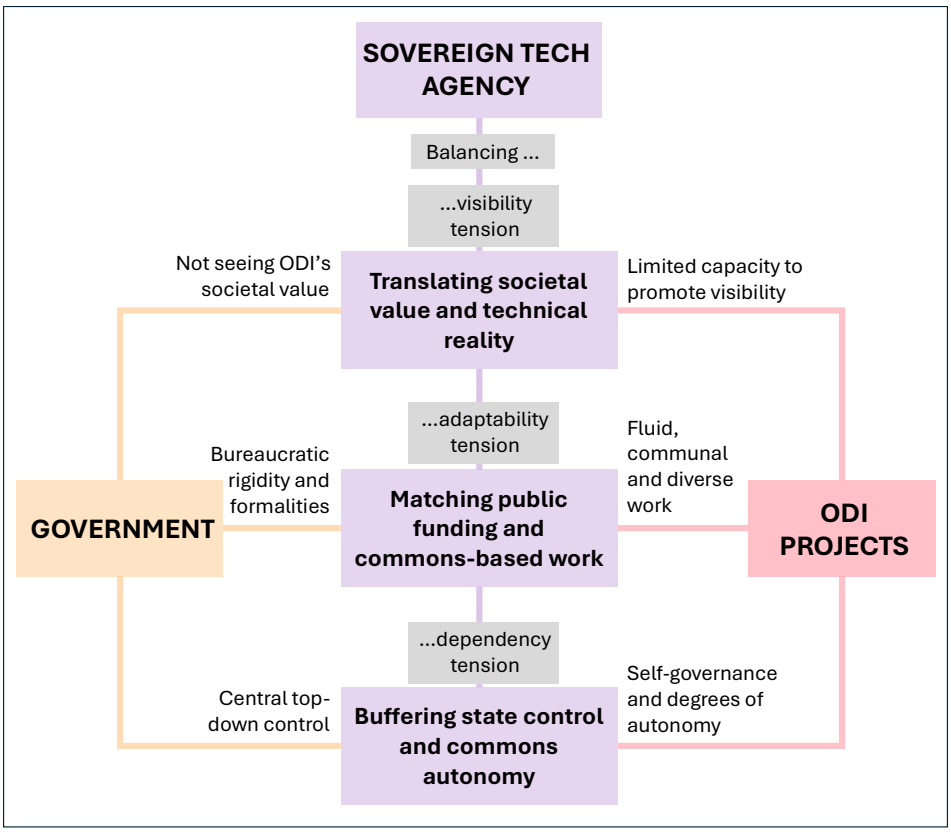
Second, the STA actively aligns with and reinforces key trends in the open-source and digital infrastructure ecosystem. The team monitors and follows trends by participating in international forums like the IETF and Linux Foundation Open Source Summits. A key example is the STA's support for memory-safe programming languages like Rust, which reduce vulnerabilities from improper memory use (cf. the STA's position on memory safety, Tarakiyee 2024). While C and C++ remain industry standards, adoption of safer alternatives has been slow. The STA's support of projects such as Prossimo's, Trail of Bits', and SequoiaPGP's work on Rust integration in Python reflect their commitment to broader trends.

Third, standards are essential for interoperability, security, and scalability in digital ecosystems. The STA's funding supports both existing standards and the development of new ones. For example, the STA funded OpenMLS, one of two implementations of a newly adopted IETF standard RFC9420 (Internet Engineering Task Force 2023). This support enabled updates to the latest technical specifications, accelerating alignment with global standards and promoting broader adoption.

4 Balancing Tensions in Support for Open Digital Infrastructure

Effective public support for ODI requires the STA as an intermediary to balance tensions between government and funded ODI projects. The previously introduced forms of direct and indirect support operate within the context of these tensions. Recognizing these tensions is essential not only for the STA's ongoing evolution but also in designing future public forms of support for ODI. We identify three central tensions – visibility, adaptability, and dependency – that the STA must balance as an intermediary (see Figure 3).

Figure 3: Balancing tensions in Open Digital Infrastructure support



Source: Authors' illustration

4.1 Visibility Tension

Description of tension

One key tension in the context of ODI arises from its largely invisible value to society and to governments in particular. On the one hand, governments often struggle to recognize the societal importance of ODI due to its technical complexity, behind-the-scenes nature, and global rather than national jurisdiction. ODI functions as the fundamental but largely invisible backbone of countless digital systems. Its status as a public good, similar to water systems or roads, is not as readily apparent to governments.

In turn, this invisibility results in limited public support and recognition for the critical work of ODI projects. ODI projects often lack the capacity to actively enhance their visibility, yet without it, they struggle to secure public funding and support.

Balancing visibility tensions appears crucial for the long-term sustainability of ODI projects, yet addressing this challenge is often beyond ODI projects' capacity. As highlighted in one of our expert interviews, delegating this balancing work to intermediaries like the STA is one possible approach to mitigating this issue:

> "ODI projects provide critical infrastructure, but communicating their impact should be handled by others, such as the STA or tech journalists. Expecting projects to focus on visibility risks distracting them from their core work."

Translating societal value and technical reality

The STA addresses the visibility tension by translating between the technical complexities of ODI and its societal value. This translation work can help make ODI's role more understandable and accessible to governments and the public. Governments often lack the technical expertise to fully appreciate the significance of ODI.

The STA approaches translation by simplifying technical complexities, reducing tech jargon, and framing ODI's value in a way that is more accessible to non-technical audiences.

For instance, on its website, the STA interweaves technical language by zooming in on the technical reality, e.g., by describing GStreamer as

> "a general multimedia processing framework [...] that manages the real-time transport of audio and video data" – and zooming out by communicating societal value via broadly accessible language and value demonstration, stating: "From elevators, cars, ships, trains, and planes to the International Space Station, GStreamer is used in entertainment, security, and even medical devices." (www.sovereign.tech/tech/gstreamer).

Translation helps the STA reach diverse audiences through accessible language that ODI projects alone are unlikely to achieve. One interviewee from a funded ODI project commented on the STA's work of translating the technical realities for mainstream and new audiences:

> "They do a good job speaking publicly. Personally, I've rarely been featured outside tech media. The STA brings this conversation into the mainstream, which might benefit us all."

Early on, the STA recognized the importance of translation and hired a communication manager dedicated to voicing their mission and engaging diverse audiences. Ultimately, translation involves a trade-off, as one interviewee reflected on the STA's representation of their ODI project:

> "A simplified representation was chosen, which is more or less accurate to reality. It's always a trade-off: whether to present something very accurately but make it incomprehensible, or to simplify it significantly for better understanding."

Furthermore, effective communication between governments and ODI projects necessitates the bridging of linguistic barriers, such as adapting predominantly English outputs into German to meet the language preferences of ministries and public administrations. The entire STA team is fluent in both English and German, and most official communications are available in both languages.

To further enhance the impact of its translation efforts, the STA incorporates creative tools such as metaphors, analogies, and art to highlight the critical role of ODI. For instance, by describing ODI as the "roads and bridges" of the digital sphere in their public talks, the STA makes it easier for non-technical audiences to understand its significance. The STA team also makes excessive use of the popular "Dependency xkcd-webcomic" in their presentations.

During a public event for one of their funding programs, STA collaborated with artists to create an interactive sculpture that demonstrated the interdependencies of digital systems (cf. www.sovereign.tech/programs/bug-resilience/research-event). The installation reacted to phone signals, visually showcasing how small disruptions could reveal systemic vulnerabilities. With this kind of storytelling STA intends to help diverse audiences, including policymakers, civil society, and the general public, to grasp the often-abstract importance of ODI.

4.2 Adaptability Tension

Description of tension

Another key tension in the context of ODI revolves around the adaptability of funding to both governments and ODI projects. Governments rely on standardized metrics and rigid fiscal cycles, requiring public funds to be highly formalized for compliance. In contrast, ODI projects function as fluid, decentralized networks, combining paid and volunteer work, as well as technical and managerial tasks, while adapting dynamically to emerging needs.

The STA's challenge is to align formal funding timelines and amounts with the fluid and evolving nature of ODI work. As one STA team member put it, "throwing money at [ODI] projects doesn't solve the problem".

While public funding is meant to strengthen ODI, it also creates administrative burdens. Managing funds requires budgeting, invoicing, legal processes, and reporting – tasks many ODI projects previously handled more organically. These tasks can be an additional burden for ODI projects (Geiger/Howard/Irani 2021). ODI contributors reported challenges in hiring within set timelines, handling *Fund*-related disputes, and adapting to the STA's fixed funding cycles, which offer limited flexibility due to annual budget constraints.

Matching public funding and commons-based work

The STA cannot fully eliminate adaptability tensions but mitigates them by testing flexible funding models. While the Sovereign Tech *Fund*, *Resilience*, and *Fellowship* programs are not one-size-fits-all solutions, they seek to offer support from different angles (see 3.2). For example, the STA's structure for the Sovereign Tech *Fund* allows it to fund various ODI projects – individuals, for-profits, and non-profits – through invoicing based on service agreements. The main bureaucratic prerequisite is a legal entity, but projects can retain their internal commons-based structure. Some communities created temporary legal entities solely to meet funding criteria, while their internal structures remained unchanged.

Furthermore, the STA's flexibility regarding those it funds differs from many private sector or individual donations to foundations, which typically require recipients to have non-profit status for tax-deduction purposes. This reflects the STA's recognition of the diverse range of actors contributing to ODI. Moreover, in the Sovereign Tech *Fund*, ODI projects can

also make decisions flexibly regarding internal salaries, hiring, and contract durations with their internally hired developers.

The STA's key balancing activity in adapting funding to ODI work lies in cushioning bureaucratic burdens while ensuring compliance. As a federal agency, the STA must comply with bureaucratic standards while ensuring maintainers, often technical experts rather than project managers, can focus on their work. One ODI project emphasized: "Software developers want to focus on coding not on fundraising, project management, or time tracking".

The STA cushions bureaucratic demands to reduce unnecessary complexity while maintaining compliance. This is supported by their internal technical expertise, allowing them to better understand the needs and challenges of ODI projects. As one ODI contributor noted, "They understand what we are doing. You can feel they have experience in tech". According to the STA, "internalization of complexity" is a key goal in their operations: "We filter requirements for application platforms, processes, and contracts to ensure projects only provide the necessary information".

Many interviewed ODI projects find the STA's requirements less burdensome and more flexible than other funding programs. Written milestone progress reports and final funding summaries are required by the STA, but these reporting requirements were generally perceived as reasonable. The STA provides ODI projects with flexibility in how they structure their reports, allowing them to choose formats that align with their workflows. Some teams used more detailed milestone-based listing, and others more written reporting.

Another key tension for the STA is the bureaucratic need to measure and justify public investment, even though much of ODI's commons-based work resists standard quantification. Governments tend to to enforce standard metrics and measures on communities and complex forms of social value creation (Scott 1998). However, values such as commons-based governance, working conditions, democratic checks and balances, and holistic sustainability are often invisible. Even publicly visible code contributions on platforms like GitHub only provide a simplified, standardized snapshot of the actual work being done.

While the STA is developing a more sensitive qualitative and quantitative mixed-methods toolkit to balance economic, social, and technological impact evaluation (see Osborne et al. 2024 for a STA co-authored study on developing a toolkit for measuring impact), ODI projects stress that external metrics rarely capture the depth of their work. Over-reliance on rigid evaluations may create additional pressure on projects and shift priorities. It is important for the STA to strike a balance, using measurement

to inform funding decisions without allowing it to become a restrictive prerequisite that limits flexibility, inclusiveness and fairness.

Another challenge lies in the question of who conducts these measurements. Dependency relations between ODI projects and funders (or some third-party evaluators that they hire) influence the outcomes of impact assessments. Some projects might be hesitant to express concerns when reliant on funding. This dynamic could lead to overly harmonized or distorted evaluations, subject to power dependencies (see Chapter 4.3).

4.3 Dependency Tension

Description of tension

A third tension in public support for ODI is balancing the influence of centralized state funding with the decentralized community-driven autonomy of ODI projects. Governments provide financial resources but may exert top-down influence, perhaps prioritizing national interests over the global public good. In contrast, ODI projects rely on community-driven, consensus-based decision-making. These self-organized systems often manage shared digital resources more effectively by fostering social trust, virtual collaboration, and adaptability beyond private interests for monetization and national political agenda (Ostrom 1990).

Ideally, the interests of government and ODI projects will complement each other. However, ODI projects' need for funding can make them vulnerable to external control and state-aligned agendas. The challenge for the STA is to provide support without undermining ODI's self-governance and independence as digital commons.

While diversified funding sources could help ODI projects maintain independence, in reality, many rely on centralized funding streams, such as STA, to sustain their work. As one ODI project noted: "I would have preferred many small contributors, companies chipping in, say, 500 Dollar regularly. That would be ideal. But that's not how it works."

Buffering state control and commons autonomy

The STA's funding aims to support ODI projects' autonomy by commissioning work that aligns with both their notion of public interest and the projects' own agenda. For the STA, the challenge lies in providing financial support without creating structural dependency.

While smaller ODI projects may rely heavily on the STA for survival, larger and more diversified projects often have a more complementary form of support with limited dependency. This distinction cannot be fully controlled by the STA, as dependency levels vary by project. In terms of funding duration, one interviewed ODI project noted that the STA's shorter funding cycles, typically six months to two years, may reduce dependency risks, aligning more closely with the commons autonomy. While longer-term funding would offer greater stability, it could also deepen reliance on a central entity.

Assessing how and to what extent the STA steers ODI projects is key to understanding the dynamics of dependency between government funding and ODI's autonomy. Through its main program, the Sovereign Tech Fund, the STA steers projects via service agreements that outline jointly defined funding milestones and objectives. During selection, the STA collaborates with ODI projects to set milestones that align with their mission of public interest. While milestones are occasionally adjusted, STA respects project teams' expertise and provides constructive feedback.

Interviews with ODI projects indicated that the STA's milestone-based steering and prioritizing approach was perceived as non-extractive, balancing autonomy with accountability, and occasional pushbacks were considered legitimate. As one project noted, "They never told us exactly what to do. They just said, 'The milestone list looks good. What matters most to us is …'". Minor "pushbacks" from the STA, such as requests for additional clarification, were also considered "legitimate" by ODI projects.

Mutual trust played a central role in the STA's steering. One interviewee described it as "reasonable and trust-based". Following Lindinger, Kloiber and Meyer (2020), trust is essential for effective collaboration with ODI projects.

On the one hand, unlike traditional infrastructure, ODI work is fluid, often invisible, and difficult to track, making external assessment by the STA challenging. As one interviewee explained, milestones served as meaningful and subtle steering to mitigate difficulties in detailed assessment:

> "You can't seriously discuss this [the work] with funders. No one from the outside can accurately judge how much time is needed. They [the STA] don't micromanage time management but place trust in you as an expert. The milestones themselves can be discussed, which makes sense."

On the other hand, ODI projects are generally sensitive to external control and dependencies, making trust a crucial factor in maintaining a balanced funding relationship with the STA.

ODI projects with closer private sector ties present a distinct steering challenge for the STA, which must ensure that public funding strengthens

the broader ODI ecosystem rather than subsidizing private interests (see Blankertz/Kelch 2023) on positive and negative externalities in the case of the STA).

While less dependent on public funds, these projects often face internal tensions in allocating resources as commercial priorities tend to focus on revenue-generating services. Contributions to ODI's open, non-commercial public good aspects are often de-prioritized or contested within internal budgets. One ODI project with closer private sector links noted, "STA money had a goal to it", enabling them to internally prioritize work beyond market-driven demands.

5 Learnings

Our insights for the advancement of public support in ODI build on the visibility, adaptability, and dependency tensions discussed in Chapter 4. While the STA has taken important steps to balance these tensions, advancing sustainability in ODI further will require a broader collaborative effort by various actors (see Table 2 for an overview).

Table 2: Overview of learnings on how different actors could further advance public support for Open Digital Infrastructure

Actor	**Visibility Tensions**	**Adaptability Tensions**	**Dependency Tensions**
Public Support Institutions (e.g., Sovereign Tech Agency)	Making the need for private sector contributions more visible	Offering capacity building for ODI projects	Institutionalizing more transparent and commons-based governance
Projects and Communities	Communicating criticality, relevance and use	Using public funding to strengthen self-reinforcing dynamics	Reassessing governance and dependencies
Governments	Recognizing ODI as a public good	Shaping boundary conditions for ODI compensation	Enabling digital commons and ensuring autonomy
Worker Representation Initiatives	Representing and unifying the interests of ODI workers		

Note: ODI: Open Digital Infrastructure
Source: Authors' representation

5.1 Public Support Institutions

While our insights are drawn from the STA, they have broader relevance for other public funding organizers, despite the STA's unique German context and history. As a young and still evolving agency, the STA already operates with limited resources and a culture of experimentation and learning. Thus, our recommendations aim to inform strategic adjustments rather than impose prescriptive solutions.

Making the need for private sector contributions more visible

The STA has helped bridge visibility gaps between ODI projects and governments (see 4.1) while advocating for greater government involvement (see 3.2). However, the mobilization of substantial private sector support for ODI is a vital, still missing piece of the puzzle. Large tech firms rely heavily on and benefit from ODI, yet contribute disproportionately little to its sustainability.

The STA could highlight this issue more actively in public discourse without altering its mission or taking an adversarial stance. While the STA acknowledges private sector challenges, both shortcomings and Big Tech dominance, its public advocacy has underemphasized them. Few credible actors can effectively raise this issue, and ODI communities lack the leverage to push for change. The STA is uniquely positioned to advocate for corporate transparency, highlight funding gaps, and promote fairer ODI contributions.

However, this requires strategic caution. Open confrontation could alienate corporate allies and undermine the STA's neutral position. Instead, framing the discussion around systemic solutions, transparency, and shared responsibility would integrate ODI funding gaps into mainstream policy debates without jeopardizing the STA's position as a public-interest advocate.

Offering capacity building for ODI projects

The STA has made ODI funding more flexible through programs like the Sovereign Tech *Fund*, *Resilience*, and *Fellowship,* while also attempting to lower bureaucratic hurdles. However, adaptability challenges persist – not just in funding structures but also in how ODI projects handle governance, organization, and community dynamics as funding increases their

workloads. This requires managerial capacity, not just financial support (see 4.2).

In our interviews, many ODI projects expressed the need for additional on-demand guidance in governance, organizational structures, and workflow management. The STA is well-positioned to offer non-imposing support, such as counseling and advisory resources that projects can access only when needed.

Beyond direct advising, peer learning and knowledge-sharing could be helpful. For instance, the STA has experimented with bringing funded projects together at community evenings after the pilot round, which received positive feedback. By combining financial support with optional advisory services, peer exchange, communities of practice and best-practice sharing, the STA could ease adaptability tensions more, helping ODI projects integrate public and potentially also private funding without disrupting their decentralized work structures.

Institutionalizing more transparent and commons-based governance

Public funding for ODI operates within a tension between centralized, state-driven, top-down control and the decentralized, self-organized nature of ODI projects. The STA sits at this intersection, balancing public oversight with ODI's commons-based structures. The STA's role as a federal agency with privileged financial resources inevitably embeds forms of public authority.

Given ODI's global, decentralized nature, maintaining structures that institutionalize transparent and participatory decision-making would further reinforce the STA's role, not as a centralizing state force but as a supporter helping decentralized digital commons to flourish. This could include transparent expert selection processes, independent checks and balances bodies, or publicly accessible decision-making rationales. Currently, the STA engages external experts for technology assessments, yet little is publicly visible regarding their selection process and role. Improving transparency in these areas should be a long-term goal, without over-bureaucratizing the STA in its early years.

As a federal agency with civil society and tech community roots, the STA differs from top-down state instruments, blending public sector resources with community expertise and values. This positioning presents an opportunity to further align its internal structures with ODI's commons-based governance models.

5.2 Projects and Communities

ODI projects and communities already carry a significant workload in the maintaining of essential infrastructure. Rather than prescribing additional responsibilities, our insights aim to complement existing efforts by identifying ways to increase visibility, adaptability, and mitigate dependencies within the broader ODI ecosystem.

Communicating criticality, relevance, and use

ODI's societal value remains underrecognized. The STA has gone some way to bridge this gap (see 4.1), and ODI projects should not bear the burden of advocacy, as their primary focus is infrastructure development. However, low-effort communication efforts can enhance visibility without diverting too many resources.

One straightforward approach is to include brief factual acknowledgments on project websites, documentation, or blogs, highlighting who relies on the technology, its role in digital infrastructure, usage dependencies, and funding challenges. Potentially, this will help to inform future public discussions without requiring extensive outreach.

In past funding cycles, the STA has occasionally identified publicly shared "cries for help" during its scoping process and proactively reached out to ODI projects. Some ODI projects already do this. A good example is Daniel Stenberg's blog posts on curl, illustrating its widespread but invisible use in Tesla, Toyota, Android, iOS, and major platforms like YouTube and Netflix. Such efforts contextualize ODI's importance while supporting broader advocacy (cf. Stenberg 2018, 2021).

Using public funding to strengthen self-reinforcing dynamics

Public funding provides essential resources for ODI projects but can also lead to administrative burdens and short-term disruptions (see 4.2). To maximize benefits, projects could identify and invest in self-reinforcing mechanisms – structural improvements that continue adding value beyond the funding period.

Rather than focusing solely on immediate and reactive deliverables, funding can enhance internal processes, community engagement, and accessibility to build long-term resilience. Key investments include improving documentation for new contributors, strengthening community

management, and expanding visibility to attract users and collaborators. The impact of public funding depends on how well improvements can be integrated into a project's structure. By strategically directing resources toward lasting benefits, ODI projects can ensure funding acts as a catalyst for long-term sustainability rather than a temporary fix (see Chapter 3.3, section on sustained changes for an example).

Reassessing governance and dependencies

ODI projects face governance and funding challenges in balancing financial stability and long-term sustainability. Some rely on volunteers, others employ firm-paid developers, and many adapt over time based on available opportunities. No single model fits all, as projects must navigate public, private, and community-driven resources to sustain their work. Ultimately, a sustainable ODI governance model requires collaborative efforts between governments, markets, and communities. Most ODI projects are quite aware of these challenges; however, they could proactively reassess their governance needs at times when the STA's public funding offers temporary relief.

Navigating this challenge is an exhausting but necessary process, in which public funding can also serve as an opportunity for reflection on governance structures (see Chapter 3.3, section on reassessing governance structures for an example). Some projects find it exposes sustainability gaps in maintenance, documentation, or governance. Others struggle with balancing paid and unpaid work or avoiding over-reliance on a single funder or maintainer. Regularly reassessing and envisioning financial and organizational dependencies can help identify sustainable structures and publicize their needs.

5.3 Governments

Recognizing open digital infrastructure as a public good

Despite being essential digital infrastructure, ODI is often excluded from public policy, budgeting, and governance strategies. Unlike roads or power grids, ODI lacks formal recognition as a public good requiring sustained investment. Instead, policy focus remains on high-visibility advancements such as innovation, while ODI maintenance and governance are secondary concerns (Denis/Pontille 2025).

In Germany, public support for ODI is often reactive, triggered by crises like cybersecurity threats or economic concerns, rather than part of a long-term strategy. Digital infrastructure policy prioritizes broadband expansion, cyber resilience, and national security, overlooking ODI's broader structural role (Bundesregierung 2024).

Acknowledging ODI as essential infrastructure – beyond security and economic justifications – would signal greater public commitment. For instance, Taiwan employs a notable model, formally integrating ODI into national infrastructure strategies. Beyond physical networks, Taiwan recognizes network security, digital culture, and research infrastructure as public assets (National Development Council Taiwan 2023).

Shaping boundary conditions for ODI compensation

Governments play a key role in ensuring ODI's financial sustainability. The STA demonstrates one approach by directly commissioning work through public funding. However, direct funding alone is insufficient – policymakers must explore complementary mechanisms like tax policies, regulations, and institutional frameworks to channel more resources into ODI. For instance, laws like the Cyber Resilience Act impose new security requirements on ODI projects. Policymakers should consider not only compliance obligations but also financial support structures to sustain these efforts. Policymakers need to find ways to ensure that more monetary support reaches ODI projects effectively.

A well-designed policy framework ought to ensure that ODI funding remains consistent, independent, and resistant to short-term political shifts. Governments can improve ODI sustainability by creating funding structures that balance public investment with ODI's decentralized nature, ensuring resources flow predictably without creating corporate dependencies or distorting the ecosystem.

Enabling digital commons and ensuring autonomy

Governments should enable ODI rather than control it. As a global open infrastructure, ODI should not be reduced to a national strategic tool but supported as a decentralized, community-driven digital commons. Public investment must be long-term and independent to prevent funding dependencies that could undermine ODI's autonomy. Finding a symbiotic relationship in governments' support for digital commons through policy is crucial for coordinated decision-making around the strategic direction of

democratized digital infrastructure (Digital Commons Policy Council 2024).

The STA demonstrates how governments can finance digital commons while maintaining high degrees of ODI project autonomy. To guarantee this, instead of imposing rigid oversight, policymakers could identify, recommend and communicate public sector and society needs in areas such as health, education, and other essential services, leveraging insights from the relevant ministries to guide ODI funding towards broader societal priorities.

Current debates on digital sovereignty illustrate potential tensions between state-driven agendas and the decentralized nature of ODI. Some policymakers emphasize digital sovereignty as a means to enhance national security and economic resilience, which may conflict with ODI's global, community-driven model, at least in its perception. As Lilith Wittmann pointed out in a keynote at the Chaos Computer Club event, equating digital sovereignty with "digital nationalism" risks undermining the definitive openness and community nature of the digital commons (Wittmann 2021).

The STA frames digital sovereignty as the self-determined use of digital technologies, aligning with ODI's commons-based principles. However, as the term remains politically contested, there is a risk of it being repurposed for political mobilization or national protectionist policies, shifting the focus away from a truly open and decentralized digital infrastructure.

Historical examples show the risks of government overreach in open-source communities. The US Open Technology Fund, for instance, has faced criticism for aligning too closely with national foreign policy objectives. To date, the STA has largely avoided similar critiques by focusing on public-interest maintenance work rather than advancing state-driven agendas. Interviews with ODI projects indicate that the STA is widely perceived as independent from Germany's foreign policy, reinforcing its legitimacy within the ecosystem.

However, future tensions could arise from political actions linked to the STA's government backers. For instance, BMWK-affiliated politicians who supported the STA's development recently voted in favor of biometric facial recognition using publicly available Internet data (Deutscher Bundestag 2024b). While unrelated to the STA's work, such policies have raised concerns within Germany's digital civil society about potential conflicts with the openness, transparency, and self-governance principles that underpin the digital commons (Kurz 2024).

5.4 Worker Representation Initiatives

Representing and unifying the interests of ODI workers

ODI contributors often work outside traditional labor structures, lacking stable employment protections. Many are freelancers, independent contractors, or unpaid volunteers, spread across decentralized projects, foundations, and corporate-backed initiatives. While ODI communities are self-organized and strong, they lack collective mechanisms to advocate for fair compensation, labor protections, and long-term sustainability.

Various initiatives, including industry dialogues and worker representation efforts, could help address challenges faced by ODI contributors and ensure their concerns are acknowledged in broader policy discussions. A national-level industry dialogue, led by traditional labor unions, could bring together companies, communities, and government actors to discuss job security, funding stability, and fair compensation. Legal guidance on employment status and sustainable compensation models could assist contributors to better navigate complex labor structures.

Examples of initiatives are the Crowdsourcing Code of Conduct (https://crowdsourcing-code.com/) or grassroots collectives such as the Berlin Tech Workers Coalition (https://techworkersberlin.com/). These initiatives could contribute expertise and advocacy to strengthen ODI work. As an intermediary, the STA could facilitate connections between ODI projects and relevant stakeholders, helping to bridge gaps between decentralized communities and institutional labor representation efforts.

6 Outlook: Public Support for Sovereign Digital Commons?

This learning report has shown that well-designed public support for ODI, despite inherent tensions, can strengthen rather than compromise the autonomy of the digital commons. While public involvement in ODI has often raised concerns about bureaucracy, political interference, or compatibility with decentralized commons-based organizational forms, the STA demonstrates that such support can be compatible and effective.

Though not a universal solution, the STA has already demonstrated tangible impacts on the sustainability, security, and openness of ODI. Public funding serves a distinct purpose – it compensates maintenance work carried out by a strained digital civil society and supports foundational digital infrastructure that private sector investments often overlook.

Crucially, public support instruments such as the STA can strengthen ODI's autonomy rather than imposing state control, demonstrating how public funding can support the digital commons without compromising its decentralized nature. This role becomes even more critical as ODI operates between two dominant forces: monopolistic Big Tech capitalism on the one hand and authoritarian, techno-autocratic regimes on the other.

The need for independent, resilient, and decentralized digital infrastructure has never been more urgent, especially as recent political developments highlight growing threats to digital openness. For instance, joint efforts by the US government and tech billionaires to weaken EU enforcement of the Digital Services Act and Digital Markets Act illustrate how powerful actors are attempting to shape digital environments in their favor (Rankin 2025). At the same time, far-right movements within Europe are adopting these narratives to undermine EU institutions and civil society from within.

Against this backdrop, public support for ODI is not about picking sides but about safeguarding foundations for a pluralistic, democratic, and open digital world. ODI is a shared resource that benefits states, corporations, and individuals alike. Strengthening ODI is not a radical alternative in combating power asymmetries, but it has the potential to enhance existing social, political and economic trends towards democratization and decentralization as part of a systemic gradual socio-technical reconfiguration (Schrape 2024).

The STA's role in strengthening the commons is evident in investments such as the ActivityPub Test Suite, which enhances interoperability for decentralized social networking platforms like Mastodon and Pixelfed. Such initiatives ensure that federated digital ecosystems remain viable,

reducing dependencies on monopolistic tendencies and fostering more diverse, open and self-determined digital environments.

The STA's work aligns with broader efforts to reinforce digital sovereignty beyond state and market control. As highlighted in a recent open letter from European digital civil society organizations:

> "Now is the time to double down on EU tech sovereignty [...] to invest in a diverse and decentralised digital sphere that is part of a sovereign digital commons." (Open Letter to the European Parliament 2025)

This call is gaining in urgency in light of growing tech capitalist pressures that threaten a democratic digital realm.

Ultimately, the need for a resilient, open, and independent digital infrastructure extends beyond Europe: The digital commons must be preserved as a global resource, enabling collaboration, communication, and self-determination. Looking ahead, governments worldwide have an opportunity to play a more active role in ensuring the long-term sustainability of ODI – not as owners or controllers, but as enablers of a decentralized, democratic, and open digital future.

Overall, our learning report should encourage experimentation with new forms of cross-sectoral interfaces that enable support for the digital commons. The STA represents such an experimental organizational intermediary that can serve as a blueprint for societal learning.

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Appendix

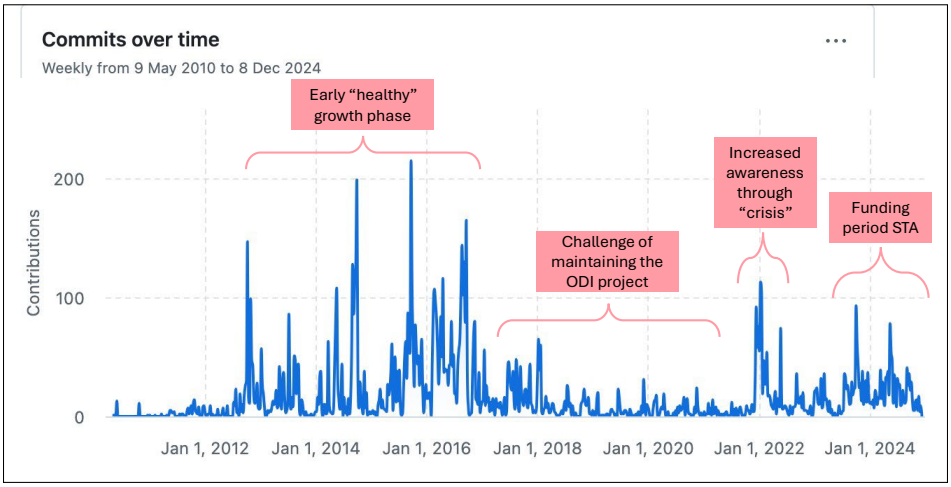
Table 3: Overview of different forms of monetary support for maintaining different types of Open Digital Infrastructure

Actor	Provision of money	Type of ODI	Limitation	Example
Private	Paid employees of private firms	Tied to a firm's core infrastructure needs, critical for own business	Firm priorities may take precedence over broader public needs	Intel employees contributing to the Linux Kernel
Private–(pseudo) public	Non-profit foundations funded by firm sponsorships	Strategic infrastructure directly tied to firms' broader ecosystem	Private sector tax-deductible "donations" grant governance privileges (tax deductions as subsidized public money)	Cloud Native Computing Foundation with AWS holding board seats
Private–communal	Donations from firms or individuals to community-led projects	Ancillary or ecosystem-enabling projects (e.g., general-purpose)	Sparse and unpredictable; typically favors projects that align with donor priorities	Spotify using GitHub Sponsors to support selected projects they depend on
Communal–private	Maintainer with commercial support offering or small business	Offering commercial services or running related small businesses	Dependent on market viability; maintainers face additional strain	Curl with support options from WolfSSL

Communal (donations)	Community-based monetary donations	Various infrastructure projects without direct market ties	Relies on voluntary contributions, which are often insufficient	ODI funded by individual donors
Communal (volunteering)	Volunteer-driven work with no ODI related compensation	Critical and deeper foundational infrastructure	Reinforces inequalities. Participation limited to those with financial capacity	Log4j maintained by a few individuals
Public	Government or inter-governmental funding	Public goods (e.g., security tools)	Dependent on politics, policy and bureaucracy	STA funding foundational ODI

Notes: ODI: Open Digital Infrastructure, STA: Sovereign Tech Agency
Source: Authors' representation

Figure 4: Contributions to Log4j from 2012 to 2024



Source: GitHub – Commits over time (edited)

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