

Making Impact Visible in Funding of Open Source Software: A Study of the Funders' Perspective

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Abstract

Background. Open Source Software (OSS) remains underfunded, threatening the sustainability of critical digital infrastructure. In response, several public, private, and philanthropic funding initiatives are emerging. However, demand greatly exceeds supply, underscoring the need to increase funding and improve the efficiency and impact of existing funding sources.

Aims. This study investigates how OSS funders conceptualize, measure, and report funding impact, and the implications for sustaining and funding OSS projects. We focus on how funders select projects, define objectives, measure outcomes, and justify continued funding.

Method. We conducted a qualitative study based on semi-structured interviews with 25 participants representing funders, funding recipients, and research organizations in the OSS ecosystem. The findings were synthesized using thematic analysis and validated and enriched through a follow-up workshop with 16 participants from overlapping organizations.

Results. We find that impact is typically measured through short-term, milestone-based deliverables and qualitative narratives, and is dependent on personal funder-recipient relationships. Long-term sustainability, risk mitigation, and human-centered impacts are difficult to capture and rarely measured systematically. Measurement practices are shaped by (often implicit) funder strategies, funding structures, and reporting requirements, leading to ad-hoc and project-specific approaches.

Conclusions. Measuring and reporting funding impact remains a shared and non-trivial challenge for OSS funders. Addressing this requires explicit impact logics and shared meta-frameworks (rather than universal metrics) to enable a more coordinated and complementary OSS funding ecosystem. This, in turn, can improve the effectiveness, accountability, and availability of funding and ultimately support the long-term sustainability of OSS as critical infrastructure.

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1 Introduction

Open Source Software (OSS) is a critical component of modern software supply chains [1, 39]. A key concern is the ongoing development and sustainability of the projects that produce critical OSS [16, 26]. Access to funding, either through business models or direct funding, plays an important role in enabling OSS development [25]. However, access to sustainable funding is a significant challenge [24]. The growing need for funding is reflected in increased



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attention from society and organizations. A range of funding initiatives, both past and ongoing, illustrate this trend. From an industry perspective, the Mozilla Open Source Support (MOSS) program¹ provided grants between 2015 and 2020 to selected OSS projects. More recently, the Alpha-Omega (AO) project [36], an Open Source Security Foundation (OpenSSF) initiative launched in 2022, has focused on improving OSS supply chain security through funding support from organizations including Microsoft, Google, Amazon, and Citi. In parallel, companies such as Bloomberg, Indeed, Spotify, Microsoft, and Google have introduced additional support mechanisms through dedicated funds, sponsorship programs, and patch grants². Organizations such as the Open Source Collective (OSC) further support OSS projects by providing financial and legal infrastructure that enables projects to receive, manage, and transparently distribute funding without establishing independent legal entities³. These examples are illustrative rather than exhaustive, and numerous other initiatives exist.

Governments are showing increased attention to OSS funding. Sci-kit learn, a Python library, has received funding from the French government as part of its national AI strategy, although there were significant administrative challenges in the funding process [33]. In 2022, the German government launched the Sovereign Tech Agency [34], reflecting the view that OSS constitutes digital infrastructure that merits public investment. The City of Munich, through its sponsorship of the Consul Democracy Foundation, illustrates how individual public sector organizations can contribute directly [28]. At the EU-level, the Next Generation Internet Program has been funding OSS projects for several years [34]. As of writing this paper, the concept for a European Sovereign Tech Fund [13] appears to be gaining traction - prototyped through the European Digital Infrastructure Project for Digital Commons⁴.

Open funding platforms have also evolved. Since 2015, Open Collective has made it easier for projects without a fiscal host to obtain one, such as the Open Source Collective or Open Source Europe, in order to transparently receive and manage funds [24]. Similarly, GitHub Sponsors, launched in 2019, embedded financial sponsorship directly into existing development workflows and developer profiles, making it easier for individuals and companies to financially support maintainers and projects [24]. Open Source Endowment, launched in 2025, is an initiative focused on creating long-term financial sustainability for critical open source infrastructure through an endowment-style funding model rather than relying exclusively on recurring donations or short-term grants.

While the number of funders indicates growing interest in supporting the OSS ecosystem, the overall level of financial support remains limited relative to ecosystem demand [13, 21]. Consequently, there is a need both to expand available resources and to improve the effectiveness, transparency, and evaluation of existing funding mechanisms [13]. However, the scale of the OSS ecosystem and the uniqueness of individual projects make it difficult to identify critical infrastructure, assess sustainability and resource needs, tailor interventions appropriately, and evaluate the downstream effects of funding decisions [16, 27]. These processes must also account for project-specific contexts alongside priorities of funders [24].

Existing work has looked at single cases [33, 34, 36], characterizing projects funded [36], discussing the practice of quantitative versus qualitative measurement, as well as the factors that need consideration. However, no study has yet undertaken a broader analysis of how

¹ <https://www.mozilla.org/en-US/moss/>

² <https://daniel.haxx.se/blog/2020/09/23/a-google-grant-for-libcurl-work/>
<https://www.bloomberg.com/company/stories/bloomberg-ospo-launches-foss-contributor-fund/>

³ <https://oscollective.org/>

⁴ <https://www.nldigitalgovernment.nl/news/edic-digital-commons-launches-first-projects/>

impact is conceptualized, measured, and reported from the perspective of OSS funders. In this study, we address this gap and seek to understand the work that goes into selecting OSS projects for funding, how funders track the impact of their support, and how they report these efforts to sustain continued funding. Specifically, we ask the question:

How do OSS funders conceptualize, measure, and report funding impact, and what implications does this have for sustaining funding and OSS?

We define funding impact as the extent to which funders achieve their objectives in providing support. We conducted a qualitative interview study with 25 participants, synthesized the findings through thematic analysis, and refined and validated them through a follow-up workshop with 16 participants. Participants included funders, funding recipients, and research organizations involved in the OSS ecosystem.

Our study identified common funder challenges in measuring and signaling the impact generated by funding initiatives. Existing metrics frequently rely on ad-hoc and case-by-case stories from funded projects. As a result, they fall short of providing value-based guidance for effective funding and evaluation, particularly for policymakers and decision-makers with limited insight into the OSS ecosystem. Understanding the systemic impacts of funding is a shared, non-trivial problem for funders. Addressing it is essential not only to ensure that resources are allocated effectively, but also to sustain and justify ongoing funding initiatives, including those supported by governments.

We make the following contributions:

- An empirical report of how OSS funding impact is conceptualized and operationalized by a diverse set of public, private, and philanthropic funding organizations.
- Identification of recurring challenges and tensions in measuring and signaling funding impact, including misalignment between funder strategies, funding structures, and the long-term sustainability needs of OSS projects.
- A characterization of dominant impact logics, metrics, and reporting practices used by OSS funders, highlighting the prevalence of milestone-based, risk-oriented, and narrative-driven approaches.
- An analysis of how funding mechanisms shape what impact can be measured, revealing structural biases that privilege short-term, deliverable-based outcomes over long-term sustainability and human-centered impacts.
- Actionable insights for funders on improving impact measurement and reporting, supporting more durable funding justifications, clearer communication with decision-makers, and better alignment between funding goals and OSS sustainability outcomes.

2 Related Work

2.1 Open Source Value

Open source software (OSS) is widely recognized as a global public good for modern technology and the economy [10, 16, 19]. OSS creates substantial economic value, but its globally distributed and collaborative nature makes that value difficult to quantify, contributing to persistent underinvestment in the ecosystems that sustain it [6, 19]. This reflects a broader public goods problem, where organizations benefit from OSS while contributing little to its development or maintenance [22, 32]. Hoffmann et al. [19] measured the scale of this problem, estimating that the cost of recreating widely used OSS is approximately \$4.15 billion, while its demand-side value reaches approximately \$8.8 trillion. OSS subsidizes innovation and productivity and enables organizations to build on existing code and knowledge work rather

than recreating it independently [12, 15]. However, this value is highly concentrated and a small proportion of developers are responsible for the majority of economically significant contributions [8, 19]. As a result, OSS simultaneously represents both an efficient and fragile system, generating immense value while remaining under-funded relative to its importance, raising critical questions about the long-term sustainability of OSS projects.

2.2 From Success to Sustainability

Early OSS research often equated project success with observable outputs such as contributor counts, commits, or user downloads; this view has gradually evolved to consider community health and, more recently, project sustainability [17]. Sustainability in OSS is the capacity of a project to continue producing high-quality software over time; however, it is not a singular or static concept, but a complex, multi-dimensional phenomenon that is inherently context-dependent and shaped by interactions between resources, communities, and infrastructure [9, 17]. Metrics alone are insufficient for this complexity. Sustainability must be interpreted through a combination of quantitative indicators and qualitative context, where meaning is derived through comparison, narrative, and stakeholder interpretation [29].

OSS sustainability is dependent on human infrastructure. Project contributors play a central role in sustaining projects, yet they face challenges related to workload, burnout, and coordination [24]. As projects grow, the demands placed on project contributors increase. Growth generates additional, often invisible work [14]. Contributions are not costless; each requires review, integration, and long-term maintenance, reinforcing the idea that sustainability is constrained by human capacity rather than technical output. Thus, OSS sustainability is a sociotechnical phenomenon that depends on the alignment of resources and labor over time. Labor in this context is not independent of resources, as sustained participation increasingly requires financial support to offset the time, expertise, and opportunity costs associated with maintenance work [24, 14]. The demands placed on maintainers and contributors exceed what can be supported through volunteer effort, making financial resources critical for sustaining labor. In this way, money becomes not just an external input, but a means of stabilizing and enabling the human infrastructure upon which OSS depends, linking funding directly to the long-term sustainability of projects.

2.3 Funding Sustainability

The challenge of funding OSS is related to its nature as a public good, creating persistent tensions between widespread use and limited financial support [19, 6]. While many widely used OSS projects receive support through corporate participation and community contributions, long-term maintenance and sustainability often remain underfunded [33, 24]. However, funding is not a straightforward solution, as different sources of funding introduce distinct trade-offs. Public funding can provide short-term stability, but funding programs are often structured around policy-driven objectives and timelines that may not align with the sustainability needs of OSS projects. Private funding can support practical development but may introduce external influence and pressure [33]. Both funding approaches are frequently structured as time-limited investments, particularly in grant-based models, resulting in temporary support that often fails to align with the ongoing maintenance demands.

The funding landscape reflects the hybrid nature of OSS ecosystems, where communities, firms, and public institutions interact. Corporate participation has become central, providing resources and accelerating development while also introducing risks of control, misalignment, and dependency [23]. Business models such as support-based services, dual licensing, com-

munity funding, and public infrastructure each offer benefits and limitations, leading many projects to adopt hybrid strategies that combine multiple funding sources [5]. Crowdfunding leverages community engagement and transparency to generate support, reframing openness as a strength rather than a limitation in certain funding contexts [2]. While crowdfunding aligns with many OSS values, it often favors highly visible projects and feature-oriented development, producing uneven and episodic support patterns that are poorly suited to the ongoing maintenance needs of OSS projects [10, 38, 24].

At the policy level, there is growing recognition of the need to support OSS as critical infrastructure. These funding initiatives emphasize long-term maintenance, community support, and the development of software ecosystems, including investments in research software and collaborative practices [20]. In parallel, cybersecurity funding efforts highlight the importance of securing foundational OSS components, particularly in software supply chains, while also acknowledging that sustainability and security are deeply interconnected [36]. Despite these advances, significant challenges remain, including misalignment between stakeholders, free-riding by organizations that do not contribute back, and difficulties in measuring the impact of funding interventions [34]. While OSS ecosystems remain substantially underfunded relative to the value they generate, sustainability challenges are also shaped by how financial resources are structured, governed, and distributed. Effective funding strategies must balance competing interests, align incentives across stakeholders, and account for the sociotechnical nature of OSS ecosystems. Ultimately, sustaining OSS requires coordinated approaches that integrate economic value, human infrastructure, and governance to ensure the continued viability of these commons.

3 Research Design

This study is an exploratory qualitative study aimed at understanding funding and sustainability challenges in OSS ecosystems. We employ thematic analysis as the primary analytic approach, as it enables the identification and interpretation of patterns of meaning across qualitative datasets while maintaining flexibility [3, 31, 30].

3.1 Data Collection

We collected data from two complementary sources: semi-structured interviews and a follow-up workshop. The supplementary material to this paper includes (a) the interview guide and (b) the workshop brief containing synthesized findings from the interviews, as discussed in the workshop, see Section 8. Table 1 presents an anonymized list of all interviewees and workshop participants. To preserve anonymity, affiliated organizations are reported alphabetically, changing the order in a separate Table 2.

Interviews. We conducted semi-structured interviews with representatives from nineteen organizations concerned with OSS funding and sustainability. Participants were selected using a combination of targeted sampling and snowball sampling [35]. Initial participants were identified through our existing professional networks, which we developed as engaged field researchers. Additional participants were recruited through referrals to broaden coverage across project types and funding contexts. Participants were selected for their deep experience and insight into OSS funding practices within their respective organizations. To provide contrast, the interviews included representatives from OSS funding organizations, including those that both provide and receive OSS funding. Interviews were conducted online, recorded, and lasted between 30 and 60 minutes. All three authors attended most

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■ **Table 1** Overview of interview (I) and workshop (W) participants, including their role and the type of organization they represent as either a funder (providing funds) or recipient (receiving funds). For organizations that both provide and receive funding, the type classification is based on how participants identified their organization.

ID	Role	Type	I	W	ID	Role	Type	I	W
I1	Policy and research manager	Funder	$\mathcal{X}$		I17	CTO	Recipient	$\mathcal{X}$	
I2	Program manager	Funder	$\mathcal{X}$	$\mathcal{X}$	I18	Program manager	Funder	$\mathcal{X}$	
I3	Program director	Funder	$\mathcal{X}$	$\mathcal{X}$	I19	Fellow	Research	$\mathcal{X}$	
I4	Co-Director / Program Management	Funder	$\mathcal{X}$	$\mathcal{X}$	I20	Deputy Director	Research	$\mathcal{X}$	
I5	Senior Program Manager	Funder	$\mathcal{X}$		I21	Associate Director	Research		
I6	Managing director	Funder	$\mathcal{X}$	$\mathcal{X}$	I22	Open Source Innovation Specialist	Funder	$\mathcal{X}$	
I7	Founder	Funder	$\mathcal{X}$	$\mathcal{X}$	I23	OSPO member	Funder	$\mathcal{X}$	$\mathcal{X}$
I8	Executive Director	Recipient	$\mathcal{X}$	$\mathcal{X}$	I24	OSPO member	Funder		$\mathcal{X}$
I9	Head of Security	Recipient	$\mathcal{X}$	$\mathcal{X}$	I25	OSPO member	Funder	$\mathcal{X}$	
I10	Executive Director	Recipient	$\mathcal{X}$		I26	Board Member	Recipient	$\mathcal{X}$	
I11	Fund raiser	Recipient	$\mathcal{X}$		I27	OSPO member	Funder	$\mathcal{X}$	
I12	OSPO member	Funder	$\mathcal{X}$	$\mathcal{X}$	I28	Community Manager	Research		$\mathcal{X}$
I13	Executive Director & CEO	Recipient	$\mathcal{X}$	$\mathcal{X}$	I29	Ecosystem development	Recipient		$\mathcal{X}$
I14	Maintainer	Recipient	$\mathcal{X}$		I30	Researcher	Research		$\mathcal{X}$
I15	Maintainer	Recipient	$\mathcal{X}$		I31	Researcher	Research		$\mathcal{X}$
I16	Researcher	Funder	$\mathcal{X}$	$\mathcal{X}$					

■ **Table 2** Organizations we interviewed and had at our workshop.

Organization	Type	Organization	Type
AlphaOmega	Funder	Internet Security Research Group	Recipient
Atlantic Council	Research	Probabl	Recipient
Bloomberg FOSS Fund	Funder	Microsoft	Funder
Chan Zuckerberg Foundation	Funder	Mozilla-MOSS	Funder
CHAOSS community	Research	Open Source Technology Improvement Fund	Funder
cURL	Recipient	Open Technology Fund	Funder
Drupal Association	Recipient	Prototype Fund	Funder
Eclipse Foundation	Recipient	Reproducible-Builds	Recipient
Erlang Ecosystem Foundation	Recipient	Rust Foundation	Recipient
Fraunhofer Research Institutes	Research	Sovereign Tech Agency	Funder
Google	Funder	UNICEF Ventures	Funder
Indeed	Funder		

interviews, alternating between asking questions and taking notes, enabling deeper probing of participant responses. All interviews were transcribed using LLM-support, manually reviewed for accuracy, anonymized, and shared with participants for validation (when requested). Data collection continued until thematic saturation was reached, with limited new insights emerging in later interviews.

FOSDEM Workshop. In addition to interviews, we incorporated data from a workshop co-located with FOSDEM 2026, an international OSS developer conference. The workshop brought together participants from academia, industry, and OSS funding organizations to discuss challenges related to OSS funding and sustainability. Several workshop participants also took part in the interviews, enabling member checking of preliminary findings and validation of emerging themes. The workshop focused on funding models, maintenance challenges, governance, and long-term sustainability strategies. The workshop was used to refine and contextualize the emerging findings rather than to provide independent validation, given the overlap in participating organizations. Workshop discussions corroborated several themes identified in the interviews while also extending the analysis by identifying additional considerations and points of consensus across stakeholders. Data included facilitator notes, recorded observations, and synthesized discussion points. These data provided complementary, group-level perspectives and were used to triangulate findings from the interview data.

3.2 Data Analysis

Data analysis followed an iterative, multi-stage coding process combining inductive and deductive techniques [3, 11]. First, all interview transcripts were read closely to establish familiarity with the data. During this phase, open coding was conducted to generate descriptive labels that capture key concepts, practices, and challenges, and analytic memoing was used to document emerging interpretations [37, 30].

Second, a structured coding process was applied using the interview guide as an initial framework. Coding was performed independently by multiple researchers, with segments often assigned multiple codes to preserve relationships between concepts. New codes were introduced inductively, and existing codes were iteratively refined through discussion [3, 30].

Third, codes were iteratively grouped into higher-level categories and themes following thematic analysis practices [3]. Relationships between codes were examined through second-cycle coding to refine and structure the developed themes [37, 30]. The analysis proceeded iteratively between data, codes, and themes until a stable thematic framework was developed [3, 4]. Themes were developed as interpretive constructs reflecting patterns across participants and data sources, rather than direct summaries of individual responses [3]. Themes were refined collaboratively to ensure consistency and coherence across the dataset. Throughout the process, an audit trail was maintained to ensure traceability, and discrepancies in coding were resolved through collaborative discussion among the authors [7]. The final themes are presented in Table 3.

4 Findings and Analysis

Our thematic analysis rendered in six interrelated aspects of funding impact that address our research question - *How do OSS funders conceptualize, measure, and report funding impact, and what implications does this have for sustaining funding and OSS?*. These aspects include: (1) vision and strategy, (2) impact logic, (3) operationalization of impact, (4) types of impact, (5) measurement approach, and (6) impact reporting (see Table 3 for an overview).

■ **Table 3** Overview of main aspects of how funding impact is measured and reported by funders.

Aspects of Funding Impact	Findings
Vision and Strategy: Defines purpose and scope, and asks what funders seek to achieve and why.	Impact outcomes are strongly driven by funder strategies that are frequently informal and person-dependent, creating fragility and limiting the institutionalization of sustainability-oriented impact over time.
Impact Logic: Articulates causal assumptions and asks how funding is expected to produce impact.	Although funders rely on implicit theories of change to guide their work, the lack of explicit and shared impact logics leads to misalignment between funder intentions, funded activities, and how impact is ultimately interpreted across stakeholders.
Operationalization of Impact: Translates intent into action, and asks how impact is turned into evaluable objectives.	Impact operationalization is largely shaped by funding mechanisms and accountability requirements, resulting in a strong reliance on goal- and deliverable-based evaluation that structurally underrepresents long-term, systemic, and risk-oriented sustainability outcomes.
Types of impact: Defines what counts as impact, and asks which dimensions of change are considered meaningful.	Funders recognize multiple, heterogeneous dimensions of impact – spanning financial, technical, social, and public-good concerns – but lack coherent means to relate or aggregate these across projects and funding portfolios.
Measurement Approach: Produces evidence of impact, and asks how impact is assessed and evidenced.	Impact measurement practices remain ad-hoc and context-specific, prioritizing what is easily measurable (infrastructure and short-term outputs) while systematically marginalizing human-centered and long-term sustainability impacts.
Impact Reporting: Communicates and justifies impact, and asks how impact is made visible and credible to others.	Impact reporting functions as translation and legitimation work, where funders construct narratives to reconcile OSS realities with the expectations of diverse audiences, rather than as a neutral reflection of measured outcomes.

4.1 Vision and strategy

Funders have their own unique vision and strategy for what they want to fund and the type of impact they are seeking to achieve. While these priorities differ across organizations, the interviews and workshop identified substantial overlap, creating opportunities for collaboration and complementary forms of support. Corporate funders were often interested in supporting the software their products and infrastructure depend on, improving internal open source culture, and maintaining influence in strategically important technologies. Foundations and government organizations more frequently emphasized ecosystem-level concerns such as security, resilience, digital infrastructure, and long-term sustainability.

The interviews and workshop further indicated that vision and strategy strongly shape how funding impact is understood and evaluated. Some funders prioritized measurable technical outcomes, such as security improvements or infrastructure development, while others viewed funding more broadly as part of community engagement, ecosystem stewardship, or organizational goodwill. In some cases, participants noted that funding initiatives were treated partly as charitable contributions, public relations efforts, or mechanisms for improving employee engagement, reducing the emphasis placed on detailed impact measurement. For example, several participants described employee-driven funding programs where employees could vote on projects to support, aligning funding decisions with organizational culture and internal satisfaction goals while also supporting OSS sustainability.

Formalizing a strategy and measuring funding impact were generally seen as important for the long-term sustainability of funding initiatives. Several workshop participants emphasized that vision and strategy are often tied to specific individuals rather than institutionalized within organizations. This creates fragility for funding organizations because when a manager, advocate, or internal sponsor moves on, there may be little long-term support structure in place for the next person taking over the initiative. The importance of personal relationships was similarly highlighted from a recipient perspective. When maintainers or other key individuals in OSS projects with established trust-based relationships with funders move on, relationships may need to be rebuilt and expected funding may disappear. Participants therefore emphasized that sustainable funding initiatives require not only financial resources, but also organizational commitment, governance structures, and continuity mechanisms capable of persisting beyond individual actors.

4.2 Impact logic

The vision and strategy of a funder set the frame for what type of impact it is looking to make, and by extension, how it is to be measured. Thus, impact is constrained by funder goals and the funding structures. Such a relationship can be expressed in a chain of impact logic, where the vision and strategy define the frame for what problem contexts are in scope, what kind of treatments are to be considered accordingly, and how short-term (project) and long-term (post-project) impact is achieved. How impact is measured or perceived may differ and align to different degrees across funders.

These relationships, or chains of logic, can have several levels, e.g., Refactoring > Simplified architecture > Improved maintainability > Easier bug triaging > Easier onboarding > Extended community. Adding APIs and improving interoperability better integrates the project into the ecosystem, thereby improving adoption and innovation. Workshop participants proposed a goal-signal-metric approach (aligning with the goal-question-metric approach), where goals are broken down into questions to ask and signals to look for, and after which metrics are defined accordingly.

The funders' strategy should ideally be based on a "theory of change" as described by I5: *"This program needs to be really tightly tied to our own internal strategy. So we need to always be able to tell a story about, how are we contributing to the short-term goals and medium-term goals in our own internal theory of change? There needs to be a very bright line between those things."*

Further, the strategy should be able to shift over time as needs and challenges evolve, while still (ideally) staying true to the overarching vision to enable impact to be traced and followed up accordingly. Workshop discussions contrasted how impact logic in reality is commonly misaligned across actors, including maintainer narratives, funder expectations, and policy objectives. These discussions confirmed that impact logic exists, but that it is often implicit, fragmented, and poorly communicated.

4.3 Operationalization of impact

Impact is operationalized through the goals that define what the funder seeks to achieve. The top-level goals are defined in the overarching strategy, while project specific goals are derived and implemented per project funded.

Goal-focused measurement. Across most interview and workshop participants, "impact" in regard to these goals is most often operationalized as whether a specific, predefined objective was completed: milestones met, issues closed, features delivered, security audits addressed,

or contracts fulfilled. This approach is described as “relatively straightforward” and “easy to justify,” even when respondents acknowledge its limitations, namely that it aligns with short-term accountability but fails to capture broader ecosystem effects. As put by I17, *“We’re looking at an open issue list and say here are the milestones that we want to achieve by funding this [...] it’s relatively straightforward. We can say, okay, have we actually closed those issues or have we hit those milestones?”* As a result, sustainability impacts are systematically under-measured because long-term maintenance and ecosystem health do not align cleanly with short-term, milestone-based evaluation models, allowing immediate proof of execution to overshadow longer-term value creation.

Risk-based measurement. In some cases, though, goals are more open-ended, focused on the expected impact, rather than the deliverables. This approach is considered difficult, with a preference for describing impact in terms of risk avoided rather than benefits delivered. Examples include preventing outages, reducing security exposure, avoiding maintainer burnout, or ensuring continuity of critical services. However, respondents also note they lack the vocabulary or metrics to measure “things that didn’t go wrong.” Sustainability work is, hence, undervalued because it produces non-events rather than visible outputs. The absence of incidents is not recognized as success in current evaluation frameworks. I17 described this issue: *“It’s easy to say, ‘Oh, we funded fixing this zero day,’ but it’s hard to say we prevented having more zero days.”*

Considering funding structures. Funding mechanisms (grants, contracts, stipends) shape what can be measured. Because many funds are scoped narrowly, impact measurement is also narrowly defined – even when broader sustainability benefits are anticipated. Work-for-hire and milestone-based contracts dominate, with funders acknowledging this incentivizes short-term thinking. Some interviewees describe a mismatch between what they want to measure (ecosystem health or project sustainability) and what they are allowed to measure (deliverables). Consequently, sustainability impact is structurally deprioritized by funding design, with measurement following money, not need. I18 argued that funding structures should extend beyond direct financial support by incorporating organizational development and structured collaboration: *“One of the ways I think conversation around FOSS funding could get better is for us to move away from understanding open source... from transactional value to a value creation space. FOSS funding is not just about giving money... I think that we should be thinking holistically about how do we create more people engaged in those spaces, more leaders in those spaces, succession planning. I think that would be really interesting to have more collaborations across companies... really structured efforts to address... problems.”*

4.4 Types of impact

Characterising impact, present or future, will again depend on the impact logic and overarching vision and strategy of the funder. Impact measurement, however, differs broadly across the funders, e.g., considering technical metrics (CI usage, test coverage), financial metrics (percentage funded vs unfunded), adoption or reuse signals, and governance or process improvements. Interviewees and workshop participants explicitly reject one-size-fits-all metrics, with measurement practices often being improvised rather than institutionalized.

Financial return on investment. Impact captured in financial terms is considered valuable by funders to motivate their own continued funding, either from C-suite executives or institutional backers. While workshop discussions confirmed interview findings characterizing Return On Investment (ROI) as an important KPI, they also framed it as a latent requirement only asked for when funding is questioned.

For this reason, ROI and related metrics are still important as both policy and decision makers are generally characterized as more supportive and receptive to impact in terms of innovation and economic value, rather than a community-oriented perspective. As such, maintenance and security work need to be bridged and communicated together with innovation and economic growth, highlighting their interdependence. Communicating the value of maintenance alone is considered quite difficult.

Research is needed into how proactive security and sustainability work translates to economic terms. I17 makes the comparison to physical infrastructure maintenance: *“20% more funding for reservoirs or 20% more funding for roads? Do you measure it in potholes filled? It’s one of those things that it’s like, we don’t really know. I don’t think we have the right vocabulary both ourselves to articulate risk mitigation as impact because it is.”*

Such questions can be answered by concerned actors, but in the context of OSS, there is a lack of knowledge on how to scale and quantify costs relative to maintenance efforts. Funders and OSS projects need a shared language to communicate economic value and to aggregate economic impact across projects and ecosystems.

Security and sustainability. Security and sustainability of OSS projects are commonly highlighted as key concerns across industry and government at the project level. These metrics are also readily understood and valued by funders and technical decision-makers as legitimate signals of risk. However, these metrics may need to be translated into more general and abstract terms to be meaningful to the target audience. Measuring or characterizing the impact of mitigated vulnerabilities or overall sustainability is often considered difficult, as expressed by I14: *“You could probably track it on some kind of metrics, but like bug fixes fixed or security problems fixed or lines of code changed or whatever, but they’re all really vague and probably also very project specific. They’re not really easy for an outsider to understand or value or judge. Is that progress or isn’t it? So that’s certainly a challenge. I think it’s just a problem with maintenance. It’s such a work that is supposed to not be noticed when it works as best. No one cares about it.”*

The number of issues and vulnerabilities found, reported and addressed, as well as code coverage of tests and fuzzing are reiterated from a security and sustainability perspective among the funders. Interviews and Workshop discussions highlighted the importance of security audits for creating reference points, and ways of following up on progress. If identified issues are addressed and their number and severity decrease in subsequent audits, positive trends in project security can be narrated.

Some interviewees referenced the need for service-level, reliability, and assurance-style reporting mechanisms (e.g., service-level agreements [SLAs]), motivated by public infrastructure framing, government procurement expectations, and regulatory pressure surrounding digital public infrastructure. This emerging demand for SLA- and infrastructure-style impact metrics centered on reliability, assurance, responsiveness, and service guarantees signals a shift in concern from “what was built” to “what can be relied upon,” and represents a potential convergence point between OSS projects, funders, and policymakers.

Downstream use and adoption. A general goal for many funders is to achieve the broadest possible reach. Many interviewees and workshop participants expressed the perspective that evaluation signals should extend beyond simple user counts to include measures such as community contributions, downstream dependencies, project responsiveness, and governance maturity. However, one workshop participant emphasized *“downstream use as the only thing that matters”*, reflecting a particularly strong focus on user adoption and downstream dependencies as primary indicators of project impact.

Also important to consider is adoption among certain target groups depending on the funders' overarching strategy. Extending a solution and unlocking new groups of users can also be an important aspect as exemplified by I22: *"So we have a solution that was developed in India and has now scaled in Bangladesh. And because it was open source from, I would say, let's say a four-module platform, the government of Bangladesh was able to kind of build on top of that. And so now it's a 12-module platform and it's poised to track just millions of vaccine doses and in effect make sure that I think under 3 million children are vaccinated with the standard vaccines on an annual basis."*

Popularity and adoption integrate with security metrics, acting as a multiplier to help quantify potential cost or impact of risk. Still, it is important to consider context when understanding adoption, as what numbers are considered significant will vary, also in regard to what the level of users implies, e.g., individuals or organizations and proxies in between such as service providers and tool vendors.

Open source infrastructure projects have the potential to justify funding by reframing themselves as force multipliers for their dependencies and how they are positioned in the supply chain and what software/infrastructure they help to support. Left-pad is highlighted by several as an example of a niche project that underpins vast amounts of products and services available on the market. The European Union's Cyber Resilience Act (CRA) and increasing industry adoption of Software Bills of Materials (SBOMs) may drive positive developments in this area. Adoption, commercialization, and the emergence of new startups represent another important dimension.

Innovation and public good. Venture-style funding that does not require equity can serve as a mechanism for supporting new projects. In this model, releasing software as open source (and thereby as a public good, often meeting defined standards) can be seen as a form of ROI. This approach may provide a useful model for other funders, including government institutions. The Digital Public Goods (DPG) Standard is an important quality indicator for both open source hygiene and use cases, supported by a rigorous vetting process. The resulting DPG designation provides a clear way to communicate impact in terms of quality.

4.5 Measurement approach

There is no shared framework for measuring impact. Instead, impact metrics are tailored on a case-by-case basis depending on the nature of the project, the funding mechanism, and the audience. The lack of standardization prevents cross-project comparison, aggregation of impact across portfolios, and complicates communication of a project's value in shared terms.

Quantitative vs. Qualitative. Impact can be measured and characterized both quantitatively and qualitatively, with interviewees and workshop participants expressing a preference for the latter. Some interviewees noted that general quantitative indicators are difficult to apply across projects or may not be meaningful for external stakeholders (e.g., vulnerability counts or test coverage). Still, some funders report using quantitative indicators as they provide a frame of reference. Aggregated statistics provide a cognitive and easy way to communicate and visualize progress. Workshop participants highlighted continuous surveys of maintainers' stress levels and audits to monitor security issues as valuable tools.

Qualitative reporting based on input and testimonials from maintainers, contributors, and users can be combined with quantitative metrics (e.g., from CHAOSS⁵) to develop case-by-case narratives of how funding impacts technologies of critical importance to society

⁵ Community project focused on developing metrics and tools for analysing OSS health and sustainability - <http://chaoss.community>

and industry. These narratives should be concise and compelling to effectively communicate impact and relevance. Quantitative metrics alone cannot capture this impact, but they can support and strengthen the storytelling.

Interviews are typically conducted with funding recipients to capture the impact logic by exploring why they applied, what activities they carried out and how, the difference the funding made, and their current and future plans. In essence, funders seek to understand how funding and support have helped projects (and, ideally, where they did not have the intended effect) to improve future funding rounds.

Defining a starting point. Establishing a baseline through specific metrics enables tracking of progress and impact over time. One funder reported using surveys at admission to create a starting-point snapshot for measuring progress and impact. Several respondents reported applying the OpenSSF Scorecard to get a starting reference point in their security work, but also to help identify areas of improvement. As put by I9: *“First thing after receiving the funding was to get a landscape view of the Scorecard score for all of our projects. So we ran Scorecard everywhere, and it had us identify some of the key points that would need more attention.”*

Establishing a baseline or benchmark can reveal weaknesses that can then be addressed, for example through the development of tailored tooling. One funder reported applying OpenSSF Scorecard to funded projects (before and after support), demonstrating an improved security posture over time. Several interviewees and workshop participants also described using security audits to establish a baseline snapshot of a project’s security issues, which can then be tracked in subsequent audits and reviews.

Customized vs. general metrics. While projects may face similar sustainability challenges and threats, these often differ in their specific context due to the unique nature of each project. One workshop participant described each project as *“its own snowflake,”* reflecting the perception that OSS projects are highly heterogeneous and difficult to evaluate through standardized frameworks. Furthermore, there is no universal solution to any particular sustainability challenge, which means that impact measurement is often closely tied to both the specific project being funded and the intervention being applied.

Important aspects of impact may be lost if overly generalized frameworks are applied, which is why metrics may need to be tailored to each funded project while still allowing for some level of aggregation and general impact reporting. Interviewees and workshop participants emphasized the need for flexible, shared meta-frameworks rather than uniform metrics or rigid taxonomies. By engaging recipients, funders can define clear and measurable goals from the start to better enable impact logic aligning with the fund’s vision and strategy, and by extension, simplifying impact reporting.

Infrastructure vs. people. Technical and infrastructure-related sustainability impacts (e.g., CI capacity, update infrastructure, security tooling) are perceived as more measurable than human-centered sustainability outcomes (e.g., maintainer capacity, burnout reduction, succession planning). Infrastructure metrics are described as quantifiable, financially expressible, and easier to justify to funders. Meanwhile, human sustainability metrics are described as *“harder to explain,” “not something we’re good at communicating,”* and often invisible until failure occurs. Consequently, funding tends to gravitate toward infrastructure even when people are the limiting factor, with maintainer sustainability remaining structurally underfunded. Maintainer health and burnout were repeatedly cited by workshop participants

as critical yet often invisible concerns, aligning with interviewee perspectives. Indicators such as release cadence, responsiveness, and signs of security neglect were highlighted as potential proxy signals of stress. Process stage-gate check-ins and maintainer surveys were also identified as useful tools for assessing stress and potential burnout risk, inspired by the existing practice of wellness surveys used in eldercare contexts.

Long-term impact. Impact reporting is largely bound by grant timelines, with long-term effects communicated informally rather than through sustained evaluation mechanisms. If these can be captured more easily through cost-efficient means by funders, more long-term impact reporting and narratives of funding programs can be created and communicated. Biannual calls with recipients post project funding may enable continued monitoring of progress and impact. Creating formal and personal relationships can be an enabler for such monitoring both during and post project funding. Workshop participants stressed the importance of personal relationships, but also highlighted the fragility of them. When a person moves on, either from the funder or recipient, relationships are often “reset”. Recorded experience and relationship between the two sides, and any impact attained through funding are considered critical to address this fragility, and enable more long-term impact monitoring, as well as consecutive funding rounds. Follow-up audits focusing on areas addressed by the funding can help demonstrate its long-term impact.

4.6 Impact reporting

Format and intensity. Funders commonly survey and report impact on a predefined basis (e.g., per 1, 3, 6, or 12 months), though typically at the end of funding. Sometimes, more general and retrospective reviews are conducted to report impact across several cohorts of a funding program. Publishing the reports openly helps to further promote the impact. Web traffic metrics show that there is substantial interest in viewing impact reports, as exemplified by I6: *“Roughly 85% of our web traffic directly goes to the reports. So they do get read. It’s about 20,000 a month hits on our website specifically to read research.”*

Narrative and key messages. While some reports are general, they also capture case-specific contexts - what was done or improved or acted on, e.g., improved parsers, fuzzing, code coverage, addressing specific vulnerabilities, etc. Not all types of metrics may be generalizable or applicable across projects. Reports strive to capture patterns, challenges and opportunities beyond the impact described in the reporting, and how these can be addressed or leveraged to further improve the impact in future funding programs. Several funders recognize, however, that showing impact in the “larger picture” is difficult. It is easier to focus on the short term and answer whether and how the projects succeeded according to plan. One respondent noted that they try to communicate the impact of maintenance work with statements about how they deliver a stable and secure product that is released on time.

Target audiences. Different target audiences will require different ways of measuring and communicating impact. Some funding organizations need to consider their corporate backers and their incentives, while others need to consider their overarching government agencies/ministries. For some funders, internal sponsors were the main audience. One respondent described how their report is communicated through several means, including metrics (adoption in number of users), milestones, case studies, and technical narratives because no single form of reporting satisfies all stakeholders. Another funder described how their reporting distinguishes the ways open source funding benefits the business, the open source project, its contributors and participants, and the public good.

5 Discussion

Structural Bias Toward Short-Term and Visible Work. Funding often comes with limited horizons and a goal-oriented focus, consistent with earlier research [34]. Any impact measurement, accordingly, often takes a binary and short-sighted view, failing to capture wider effects (positive and negative) that (may) materialize further down the road. Considering risk-based scenarios and the alternative costs may provide a more systemic perspective on the potential consequences that any funding aims to mitigate. Longer-term follow-up and monitoring practices should be supported and coordinated by funders in collaboration with recipients, using both quantitative and qualitative metrics to develop a more holistic understanding of impact while minimizing additional reporting and administrative burdens on maintainers and recipients.

Human Infrastructure as the Missing Unit of Impact. The dominant goal-oriented focus further implies a preference for hard metrics, such as the number of vulnerabilities found or addressed during a security audit. Human infrastructure aspects [24], such as reducing risk of maintainer burnout, addressing toxicity, or adopting closed governance, can have an equally important impact on a project's sustainability [26]. Related work [34] also highlights the need to take a wider perspective, including social, economic, and technological types of impact. Characterizing sustainability, hence, requires several perspectives, just as a medical doctor looks for symptoms in a health-checkup [25]. Funders should accordingly explore metrics beyond merely technical, and attempt to gain as complete an understanding as possible, that can be translated into a coherent narrative and signal of any funding impact.

Misalignment Between Funder Strategy, Funding Design, and Impact Logic. Ideally, an impact-logic should be clearly defined, where goals originating from the funders' strategy are linked to impact signals looked for, and metrics are defined accordingly. This Goal-Signal-Metric approach (as proposed by the interviewees) aligns with the Goal-Question-Metric (GQM) model commonly referenced in science, and also promoted by the CHAOSS community to ensure that the right metrics are used for the intended purpose [17]. This kind of logic was generally missing or very implicitly defined among the funders surveyed. The MOSS fund stood out as a prominent example, showcasing a mature means of synchronizing and aligning an impact logic across the organization, while recognizing that it was a consequence of a long learning process. Any funder should do their own exercise in creating similar alignment, asking themselves questions about what impact they wish to achieve that aligns with their overarching strategy, what signals may be an indication of such impact, and how those signals can be measured from a social, technical, and economic point of view.

Need for Meta-Frameworks to Interface and Bridge Funders, while Balancing Over-Standardization. While the impact logic will be unique for each funder, its building blocks and design elements can still overlap. A meta-framework was called for to help bridge and interface funders, creating a better collective understanding of what impact can imply and how it can be measured against different logics. Knowledge sharing and development of a common practice can help raise the maturity of the field, enable better project funding alignment with funders' scopes, refer candidates to more suitable funders, and promote collaborative funding initiatives, potentially onboarding new funders as well. We believe a commonly defined interface for communication and collective reporting on funding impact can support a federated funding schema for the OSS ecosystem. Such a schema would be

able to bring together and grow the mass of funders, which come in many shapes and sizes as highlighted in this study. A central fund such as the envisaged European Sovereign Tech Fund would also benefit when coordinating and motivating additional funds from member states and other donors. An important caveat highlighted by workshop participants is that any framework or scheme should avoid becoming too formalized and detailed, as each funder has their own strategy and stakeholders to answer to, and at the end of the day, their own specific dialect of how impact is pronounced and discussed.

Impact Reporting as Translation Work. Based on the findings, we conceptualize impact reporting as a form of translation. Developing a shared funder language (while recognizing each funder’s own “dialect”) can support this process, helping to communicate both the need for funding and its impact, collectively and at the level of individual funders, to institutional donors and executive stakeholders. As posited by one interviewee, being able to explain, e.g., what 20% extra funding can imply in terms of impact, may be critical to motivating additional funding and the continuation of funding programs, on both the funder and recipient sides. While research in this area is growing, including studies examining how OSS contributor growth may influence broader economic outcomes such as GDP and SME development [1], as well as work exploring the alternative costs and economic value of OSS [19], further research is needed to better quantify and characterize financial return on investment in more applied and practical terms, as emphasized by the interviewee.

Implications for Supply-Chain Reliability Framing. While financial return on investment speaks to some stakeholders, it remains difficult to capture and characterize in practice. A wider narrative, also prominent in our findings, instead emphasized the sustainability and security aspects of OSS ecosystems, which were key concerns for several funders, including the Sovereign Tech Agency and Alpha-Omega. In this framing, these concerns ultimately translate into questions of reliability, resilience, and robustness of the digital infrastructure underpinned by OSS components, and by extension connect to broader policy discussions surrounding digital sovereignty and infrastructural dependency. This suggests a need for wider discussion on how impact is captured and communicated, shifting from purely goal-focused approaches toward more risk-based perspectives on infrastructure sustainability and resilience. Further research is needed to better understand how sustainability and security can be translated into such frameworks, while also integrating adoption and dependency relationships from a supply-chain perspective to better signal societal impact.

Shifting Funding Priorities. In our interviews, we heard a lot about funding for security. By the time we held the workshop, the funding landscape had changed. Workshop participants pointed out that the security topic, while still relevant, was no longer the dominant focus. We learned that what gets funded shifts rapidly depending on ecosystem-level topics. As of writing this paper, a major topic is Artificial Intelligence. We had not included a discussion of AI in our study because it wasn’t mentioned in the interviews, and its impact on the open-source ecosystem had not yet begun to unfold. We also don’t have sufficient literature to include the influence of AI on open source success. However, we know from conversations with maintainers and funders that AI is fundamentally changing the OSS ecosystem and is impacting funding decisions.

6 Threats to validity

Below, we discuss threats to validity based on the four criteria defined by Guba [18].

Credibility concerns the truth value of the presented findings. To strengthen credibility, we collected data from a diverse set of participants across roles and organization types, including funders, recipients, and research organizations within the OSS ecosystem. We triangulated data sources by combining semi-structured interviews with a follow-up validation workshop, and continuous member-checking after both activities [7]. This allowed participants to reflect on, challenge, and extend preliminary interpretations. Throughout the analysis, themes were iteratively refined through discussion among the authors and continuously grounded in empirical material [3, 31].

Transferability concerns the extent to which the findings are applicable beyond the cases studied. In this study, we do not aim for statistical generalization but rather provide analytical insights into how OSS funders conceptualize and operationalize impact. The organizations represented span public, private, and philanthropic contexts, primarily within Euro-Atlantic funding ecosystems, which may limit transferability to other geopolitical or cultural contexts. However, by providing rich descriptions of funder strategies, logics, and practices, we aim to support readers in assessing the relevance of our findings to other funding settings or sustainability challenges.

Dependability refers to the consistency and traceability of the research process. To strengthen dependability, we followed a systematic qualitative research design, including documented interview protocols, a transparent thematic analysis process, and explicit descriptions of data collection and analysis phases, including an audit trail. Regular discussions among the authors were used to reflect on coding and methodological choices [37, 30].

Confirmability concerns the degree to which the findings are shaped by the participants and data rather than researcher bias. All three authors have experience in the context of OSS sustainability and have engaged with communities such as CHAOSS. This experience brings both validity in terms of understanding, and risk of bias. To address this concern, we sought to enhance confirmability by grounding interpretations in participant quotations, explicitly linking analytical claims to empirical material, and reflecting on alternative interpretations during analysis and workshops. The iterative research design and member-checking further help to minimize the potential impact of researcher bias.

7 Conclusions

This study provides an empirical investigation of how OSS funders conceptualize, measure, and report the impact of their funding activities. We show that impact measurement is a shared and non-trivial challenge, shaped by funders' strategies, funding mechanisms, and reporting obligations. Current practices largely emphasise short-term, milestone-based deliverables and qualitative narratives, while long-term sustainability, risk mitigation, and human-centered impacts remain difficult to capture and communicate.

Our findings highlight a misalignment between funders' stated sustainability ambitions and the structures through which impact is operationalised and evaluated. As a result, funding impact is often reported in ad-hoc and project-specific ways, limiting comparability, aggregation, and value-based guidance for decision-makers with limited insight into the OSS ecosystem. Addressing these challenges is critical for sustaining funding programs over time and for justifying continued investment in OSS as critical digital infrastructure.

Rather than prescribing a universal set of metrics, funders should establish explicit impact models that connect funding objectives with measurable outputs, outcomes, and longer-term impacts. Such models should incorporate indicators of maintenance, sustainability, and risk mitigation alongside project-specific outcomes, providing a shared reporting structure that improves cross-project comparability while remaining adaptable to diverse OSS contexts. Future work should aim towards establishing a common language for conceptualizing, measuring, and communicating funding impact. This study provides a knowledge foundation for such artifacts, which we believe can provide an interface and help to bring the OSS funder ecosystem together into a more harmonized and coordinated platform, enabling improved efficiency, accountability, and availability of OSS funding. If the needs and impact of funding can be collectively explained, further and more direct funding can potentially be motivated and onboarded, and in the end contribute to a more reliable and sustainable digital infrastructure for industries and society.

8 Data Availability Statement

Interview questionnaire and workshop brief available via online repository⁶.

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