Abstract

"Standardizing Open Source Impact Metrics: A Framework for Academic Technology Transfer Offices" explores the challenges that university technology transfer offices (“TTOs”) face in promoting open source software within academic settings. The authors delineate the differences between traditional and open source technology transfer and propose a framework for incorporating open source initiatives into TTO operations. They emphasize the necessity of standardizing metrics to effectively measure open source activities, such as project consults and evaluations of community engagement. While acknowledging the difficulties in measuring open source adoption, this position paper serves as a foundational contribution to the technology transfer community, aiming to enhance the visibility of open source tech transfer in fulfilling TTO missions.

Standardizing Open Source Impact Metrics:

A Framework for Academic Technology Transfer Offices

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1. Introduction

It is the mission of university technology transfer offices ("TTOs") to produce broad scientific, economic, and societal impact from the technologies arising from the research conducted at their universities (Johns Hopkins University 2026c; University of Michigan 2026a; TODAI TLO 2026; Technical University of Munich 2026; University of São Paulo 2026). Open source software is essential to artificial intelligence research at universities and computational research in general (Kapoor et al. 2024, 4).[1] Further, open source software is a fundamental component of the technologies driving the economies in which universities are embedded (Hoffmann et al. 2024, 18).[2] However, TTOs face challenges supporting open source technology transfer because there is a lack of understanding of what such support entails and how open source technology transfer satisfies the TTOs' mission.

To address these challenges, in this position paper we: (1) outline the key differences between traditional and open source technology transfer, (2) propose a framework for situating open source within a TTO's mission and operations, and (3) suggest a set of metrics to capture open source activity by TTOs and the benefit provided by open source technology transfer.

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1 "Foundation models are critical to modern scientific research, within and beyond the field of artificial intelligence. Broader access to foundation models enables greater inclusion in scientific research, and model weights are essential for several forms of research across AI interpretability, security, and safety . . . . Ensuring ongoing access to specific models is essential for the scientific reproducibility of research . . . (Kapoor et al. 2024, 4)."

2 "[F]irms would spend $12.2 trillion (=$3.4 trillion + $8.8 trillion), or three and a half times what they currently spend if they needed to pay in-house developers to write the OSS that they currently use for free (Hoffmann et al. 2024, 18)."

2. Background on the Origin of Technology Transfer

University technology transfer originated in the United States with the Patent and Trademark Laws Amendments of 1980 (commonly known as the "Bayh-Dole Act"). The Bayh-Dole Act enables universities to own patent rights in the inventions generated from federal funding, including software (U.S. General Accounting Office 1998, 3; 35 U.S.C. § 200 2012).[3] Other major economies in the world subsequently developed similar technology transfer regimes. For example, Japan, Germany, and Brazil all have laws similar to the Bayh-Dole Act (Industrial Technology Enhancement Act 2000, art. 17; Law on Employee Inventions 2009, § 42; Law No. 10.973 2004, art. 6).

The basic theory behind regimes like the Bayh-Dole Act is that the exclusivity that proprietary rights provide are an efficient way to incentivize commercialization of technology (WIPO n.d.-b; U.S. General Accounting Office 1998, 3). A patent owner possesses the right to exclude others from making, using, or selling products or services that infringe the patent (35 U.S.C. § 154 2024; WIPO n.d.-b). Software patents can apply to tangible components storing digital copies of the software, the methods practiced when the software runs, or systems combining multiple components and methods (Cinarkaya et al. 2015).[4]

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3 Federal funding agreements underwrite the preponderance of U.S. basic science research. Before the Bayh-Dole Act, the U.S. Government owned the vast majority of patents resulting from federally funded research. By the time of the passage of the Bayh-Dole Act, the U.S. Government had licensed fewer than 5 percent of the 28,000 patents it held (U.S. General Accounting Office 1998, 3).

4 For example, US Patent 9,219,775 owned by Salesforce, Inc. claims a "non-transitory computer readable medium storing a computer program . . .," a "method, comprising: storing authentication information . . .," and a "system, comprising: a processor for: storing authentication information . . . (Cinarkaya et al. 2015)."

In addition to patents, universities generally own the copyrights in research works created by faculty and staff at the university, including software (University of Michigan 2011; Johns Hopkins University 2011, 3; University of Tokyo 2026c; Technical University of Munich 2010; Brazil 1998, art. 4). In the United States, university ownership of copyrights in research works is a result of the conditions of employment, doctrines of copyright law, and the obligations of funding agreements applicable to grant recipients (U.S. Copyright Office n.d.-b., 1-3; 2 C.F.R. § 200.315(b)).[5] The owner of the copyright in a work possesses the right to exclude others from reproducing, distributing, performing, and displaying the work, and preparing derivative works based upon the work (17 U.S.C. § 106(1)-(6); WIPO n.d.-a). Copyrightable works include software, stored compilations of data, and digital content (17 U.S.C. § 102(a)(1); U.S. Copyright Office n.d.-a., 1-2; U.S. Copyright Office 2022).[6] Both patent rights and copyrights are intellectual property ("IP") that support a proprietary licensing approach, and TTOs often include both types of rights when licensing software.

TTOs were founded to pursue the proprietary commercialization approaches required by statutes like the Bayh-Dole Act. Over the last 40 years, software has extended a computational layer across an increasingly wide portion of basic scientific research (Chue Hong et al. 2025, 2;

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5 "To the extent permitted by law, the recipient or subrecipient may copyright any work that is subject to copyright and was developed, or for which ownership was acquired, under a Federal award." This language is part of the "Uniform Guidance" provided by the U.S. Office of Management and Budget and applies in general to all federal grants awarded to universities by U.S. government agencies (2 C.F.R. § 200.315(b)).

6 Under U.S. copyright law, computer programs are classified as literary works (17 U.S.C. § 102(a)(1)).

Jensen and Katz 2025, 3).[7] TTOs have followed suit and applied their proprietary patent and copyright software licensing approaches to software innovations arising from basic scientific research.

3. Open Source and Computational Research

Open source practices have proven to be an efficient mechanism for disseminating the technology resulting from computational research (Hertweck et al. 2024, 10). At minimum, "open source practices" include releasing software to the public under the terms of an open source license, and such software is considered "open source software. (Open Source Initiative 2026)."[8] The open source license grants the public permission to practice the copyrights and (often) patent rights the software owner possesses in the open source software (Google n.d., "Introduction").[9] In addition to the open source license, there is a broad set of practices that contribute to a successful open source software project, including attracting users, growing project contributors, managing the overall community, governing the project, and establishing a

7 "The use of software is near-ubiquitous in research, yet it is still underrecognized despite changes in policy and practice (Chue Hong et al. 2025, 2)."

8 The Open Source Initiative ("OSI") emerged over the past 25+ years as the generally accepted administrator of what constitutes an "open source license." OSI maintains the Open Source Definition, which OSI uses to determine whether a license enables software to be sufficiently usable, modifiable, and shareable to constitute open source software (Open Source Initiative 2026).

9 Open source licenses are believed to vary in their efficacy in granting patent rights, though this issue has not been extensively litigated in the United States (Google n.d., "Introduction").

framework that can sustain these practices over the long term (Behrenshausen 2020; Arp and Forbes 2018).

Open source software has become fundamental technology infrastructure underpinning the global economy (Gerosa and Lawson 2025, 4-9). Software companies based on open source projects are a growing proportion of the overall software industry (Meeker 2023, 2-7). Such companies, often called commercial open source software ("COSS") companies, pursue a variety of business models that leverage their associated open source projects (Meeker 2023, 8-21). These COSS companies are also a growing focus of venture capital investment in the tech sector (Boysel et al. 2025, 10-19).

Despite the importance of open source software to scientific research and the fertile opportunity for commercializing open source software, TTOs have not generally recognized open source practices as a mechanism for achieving their missions.[10] Rather, TTOs continue to advocate conventional proprietary technology transfer strategies for computational research. We propose that there is a strong rationale for TTOs to formally pursue open source technology transfer in addition to traditional proprietary approaches.

10 There are several exceptions to this general practice such as the Knowledge Transfer Group at CERN and the Michigan Open Source Software program at the University of Michigan TTO (CERN 2026; University of Michigan 2026d). There are also many notable successful COSS companies that originated at universities without significantly participating with their TTOs. For example, Anyscale, Inc. and Databricks, Inc. are based on the Ray and Spark open source projects respectively, both of which originated at the University of California, Berkeley (Anyscale n.d.; Databricks n.d.).

4. The Nuts and Bolts of TTOs

The core function of TTOs can be described as a "report-protect-license-distribute" process (AUTM 2026b). TTOs receive "invention reports," assess the merits of the technology, and then patent and otherwise "protect" relevant IP. TTOs market the IP and license it to outside companies or startups. The TTO shares the proceeds received from the license with the faculty and staff responsible for the IP and the university.

Many TTOs supplement this core function with services that increase the number and quality of economically sustainable endpoints for university technology. For example, TTOs often provide startup incubator programs that subsidize the launch of new companies (University of Michigan 2026e; Johns Hopkins University 2026b; TU Berlin 2026b; University of Tokyo 2026a; Fundação Getulio Vargas 2026a). Many TTOs also provide corporate partnership offices that match corporate sponsorship opportunities with relevant university researchers (University of Michigan 2026b; Johns Hopkins University 2026a; University of Tokyo 2026d; TU Berlin 2026a; Fundação Getulio Vargas 2026b).

TTOs across academia generally track many of the same sets of metrics as a common measurement of success. For example, the Association of University Technology Managers ("AUTM") surveys TTOs annually across a number of metrics including: number of disclosures, number of patents, number of material transfer agreements, number of licenses, etc (AUTM 2026a). There are no robust metrics collected about university open source practices.[11]

11 Though AUTM does ask survey participants to provide the number of new open source licenses issued by universities each year.

5. Why TTOs Should Focus on Open Source

TTOs should support open source practices for policy, organization capacity, and practical reasons. The mission statement of most TTOs focuses on the general objective of translating technology to benefit the world (University of Michigan 2026a; Johns Hopkins University 2026c; TU Berlin 2026c; University of Tokyo 2026b). There is no requirement that a proprietary license be the mechanism to translate such technology.

If one looks at the policy rationale for statutes justifying TTOs, it is apparent that open source practices meet these policy goals at least as well as patent licensing for computational technologies. For example, the Bayh-Dole Act is intended to "to promote the utilization of inventions arising from federally supported research or development," promote the "public availability" of such inventions, "promote free competition and enterprise without unduly encumbering future research," and "protect the public against nonuse . . . of inventions (35 U.S.C. § 200 2012)." Open source practices have promoted the widespread use of open source software so successfully, that open source software now underpins the world economy (O'Neill 2021; Hoffmann et al. 2024, 18). Multiple COSS companies can compete on a single open source project, while the project remains publicly available to use for research purposes and further innovation.[12]

12 For example, Red Hat, Inc.; Broadcom Inc. (VMware); SUSE Software Solutions Germany GmbH; and Google LLC all offer commercial versions of the public Kubernetes project (SUSE 2023).

TTOs are generally the organizations at universities that are in the best position to facilitate open source licensing and related open source practices.[13] When software at a university is released under an open source license, the university is granting a license to copyrights and often patent rights in the software in accordance with the terms of the particular open source license chosen. Given that TTOs are the organizations designated with licensing IP at universities, TTOs should also be responsible for university open source licenses. Similarly, if TTOs are responsible for translating technology for public benefit, and open source licensing is the optimal method for achieving such translation, then TTOs should be responsible for such open source translation.

Lastly, the vast majority of software used in research at universities is open source software. Indeed, one would be "hard-pressed to find any piece of scientific literature published today that has not been supported in some way by at least a dozen if not more, open source software projects (Chan Zuckerberg Initiative 2024)." Computational researchers depend on open source software to do research and depend on open source licenses to be able to share their research as validatable scholarship.

6. The Impact of Open Source Technology Transfer

This work is based on monthly discussions over the past year with the Open Source is Tech Transfer ("OSiTT") working group. The OSiTT working group consists of individuals at thirty-

13 As discussed further below, a big exception is where universities have open source programs offices.

two TTOs, open source programs offices, and related organizations across the United States and abroad who work with open source software.[14] We had an initial goal of establishing a set of common metrics to evaluate open source technology transfer success. However, before trying to define these metrics, we decided it was best to first define the type of impact we believed open source technology transfer can make towards achieving the goals of our organizations. The following is the OSiTT group's working definition of the impact of open source technology transfer, which unsurprisingly, aligns with the mission statements of many TTOs:

> *Open source technology transfer drives impact by accelerating scientific discovery, enabling industry collaboration, promoting broad public awareness and adoption, facilitating commercialization and sustainability of open source projects, fostering startup creation, attracting external funding opportunities, advancing workforce development, catalyzing regional economic growth, and enhancing the reputation of academic researchers and their institutions.*

7. The Challenge of Open Source for TTOs

TTOs face a unique challenge when supporting open source projects because the projects often require substantial community building to achieve the impact upon which TTOs are measured. Unlike traditional proprietary software where value is captured through exclusive

14 See the Acknowledgements section for listing of OSiTT participants.

licensing, open source success depends on cultivating broad adoption and contributor ecosystems (Behrenshausen 2020, 52-66; Arp and Forbes 2018, 9). These community building activities consume significant time and resources before they can generate the revenue streams or industry engagement that typically justify TTO investment. Researchers who create open source projects also often lack the social capital, marketing expertise, and bandwidth needed to nurture communities themselves, creating both an opportunity and challenge for TTO support.

A small but growing number of universities have established Open Source Programs Offices ("OSPOs") specifically to address these unique aspects of open source (CURIOSS n.d.-b.). The CURIOSS community exists to help build the collective capacity of such organizations around the world (CURIOSS n.d.-a.). Where OSPOs exist, they can partner with TTOs to create a complementary support system for university open source projects. OSPOs can focus on community health, technical best practices, and open source culture, while TTOs contribute expertise in licensing, commercialization pathways, and sustainability models. This complementary relationship can strengthen outcomes for university open source technology transfer.

8. What TTOs can do for Open Source Projects

Open Source Tech Transfer requires additional activities across multiple areas of the typical TTO workflow. Table 1 below proposes five activity areas where TTOs can make an impact on open source technology transfer. Our hope is that TTOs can use this framework to develop their own open source support functions.

8.1 Table 1 TTO Open Source Activity

Open Source Reporting. Researchers often do not think of their open source projects as applicable to the invention reporting process. A TTO's success in tracking research often depends on the effort the TTO expends in building relationships with researchers at the institution. TTOs can apply the same resources to capturing and tracking open source projects as. Quantifying open source software at a university is a perquisite to quantifying the technology transfer impact of such software.
Open Source Licensing. The core function of TTOs is licensing IP. Therefore, TTOs are in a good position to assist researchers with all aspects of open source licensing, including (1) building open source projects with coherent internal licensing; (2) choice of license based on the project's objective (e.g. COSS startup, open source foundation, maximizing dissemination); and (3) assisting researchers is setting up license governance for their projects, such as contributor license agreements, developer certificates of origin, and contribution guidelines.
Promotion. TTOs typically have searchable websites listing summaries of all the technologies managed by the office and often run marketing campaigns for specific technology packages. Open source projects should be no different. Further, TTO websites can link to public repositories, publications, datasets, and other related resources, which can lower the barrier for potential partners to evaluate university computational research.

Community. A healthy community of contributors and users is essential to an open source project. TTOs often provide services to traditional university startups to help them with market research, customer discovery, and early product validation. TTOs can provide similar services to open source projects to help them develop strategies to help accelerate adoption, manage feature requests, and build a contributor base.
Sustainability. TTOs license IP to establish a sustainable pathway for translating university research. TTOs support business model ideation and validation for traditional university startups. Similar services can be provided to open source projects. For example, TTOs can advise on COSS startup models as well as sponsor-funded models as research endpoints.

In the context of a TTO workflow, open source practices can be seen as a logical extension of traditional TTO activities. For example, theorizing a community building framework and governance structure to support the sustainability model for an open source project is similar to determining a business model theory for a traditional software startup. Further, determining how strategic open source licensing will support sustainability via an open source business model is similar to determining how a patent claim strategy will support sustainability via a traditional proprietary business model. Table 2 below shows in bold how the above activity areas (as well as additional open source activities) map to the activities of traditional technology transfer workflows.

8.2 Table 2 TTO Workflows

TTO function	Traditional	Open source
1. Intake	● Invention reporting ● Meeting ● Review report ● Review repository	● **Open source reporting** ● Meeting ● Review report ● Review repository
2. Translation pathway	● Product ● Translational funding ● Sustainability ○ Business model theory ○ Endpoint ▪ Industry ▪ Startup	● Product ● Translational funding (including open source-specific grants such as NSF-POSE (National Science Foundation n.d.) ● **Sustainability** ○ **Community building framework** ○ **Governance structure** ○ Business model theory ○ Endpoint ▪ Industry ▪ Startup

		▪ **Open source foundation** ▪ **University project (Sustainably supported through open-core licensing or grant funding (Meeker 2023, 16-18))**
3. IP strategy	● Patent decision	● **Open source licensing** ○ **Project compliance** ○ **Choice of license** ● Trademark decision ● Patent decision (in some circumstances)
4. Technical validation strategy	● Study/testing/clinical trial	● Study/testing/clinical trial ● **Community** ○ **Community feedback**
5. Business validation strategy	● Customer discovery	● **Community** ○ **User/contributor**

		discovery ● Customer discovery ● Funder discovery (for non-COSS projects)
6. Marketing	● Promotion ● Technology publication	● **Promotion** ○ **User/contributor discovery** ○ **High-touch support for community building** ○ **Repository linking** ○ Technology publication
7. Licensing	● Proprietary licensing	● **Open source licensing** **o Public release** ● Proprietary licensing (in some circumstances)

9. Metrics

A major challenge for individuals working in open source at TTOs is the lack of visibility of the work they do supporting open source projects at their universities. Even if a TTO formally supports open source tech transfer, there is no common understanding of what that means or how TTOs would know if they are achieving their goals. Having defined the type of impact that can be achieved through open source tech transfer and examples of the types of TTO activities that can achieve that impact, we can design metrics to track such activities. Table 3 below presents an early draft of some basic metrics that TTOs can track to bring visibility to open source technology transfer.

9.1 Table 3 TTO Open Source Metrics

TTO open source activity	Metric
Open source licensing	**Number of project consults.** TTOs should track how often they are interacting with researchers to advise on license compliance activities or any other advice that might benefit the project. **Number of university-affiliated code repositories with licenses**. As a basic metric, it would be good to capture open source activity at universities in general, regardless of TTO engagement. Several

	groups are working on tools to crawl public repositories and identify university-affiliated research (Gomez et al. 2025, 1-3).
Open source reporting	**Number of open source invention reports.** If TTOs incorporate open source projects into their invention reporting process, then these projects can be captured just like invention reports in general.
Promotion	**Number of open source projects promoted.** The effectiveness of TTOs in promoting open source projects is important to evaluate open source success.
Community	**Number of users/contributors.** If TTOs are providing guidance to grow open source projects on campus, then they should get credit for the project growth that results from their actions.
Sustainability	**Number of sustained projects.** Defining what is “sustained” is difficult. Some suggestions include tracking the number of projects a TTO has engaged with that have resources which meet the business model the project is executing. This could apply to COSS startups and open source foundations.

10. A Note about Adoption

The metric most desired by the OSiTT group is “adoption” or counting the extent to which university open source projects are used by companies, startups, government agencies, and other researchers. Directly counting the use of university originated open source software outside of the university would be the best evidence for showing that universities are effectively translating university technology. Of course, measuring adoption of open source software is notoriously difficult wherever the project originates (Nagle et al. 2024, 5-6).

OSiTT is considering several options to address the difficulty in tracking adoption. For example, TTOs could deploy user surveys for university open source projects or include usage reporting conditions in industry research agreements that have open source outputs. A potential proxy for adoption could be the overall health/vibrancy of an open source project. Increasingly there are analytics tools designed to provide insight into the activities within an open source ecosystem (CHAOSS n.d.). However, these are only partial solutions at best, and we continue to explore ways of capturing adoption.

11. Next Steps

While this work establishes a foundational framework and vocabulary for open source impact, it is only a starting point. To increase the likelihood of adoption by TTOs, we propose the following next steps for the technology transfer community:

Knowledge Transfer: Disseminate case studies and experimental outcomes from TTOs and OSPOs to highlight successful strategies for supporting open source projects and

measuring their impact. This will be done primarily through the OSiTT working group as well as panel discussions at AUTM meetings.

Standardizing Adoption Metrics: Define a “minimum viable” set of tools and activities to accurately measure and describe open source adoption. This will be done primarily through the OSiTT working group as well.

AUTM Metrics: Work with the AUTM metrics committee to formalize new metrics that capture the full spectrum of TTO open source activities. This will be done after a subset of TTOs have piloted some of the metrics proposed in this framework in the upcoming fiscal year.

12. Conclusion

This work establishes a vital framework to enable TTOs to formally incorporate open source tech transfer into their missions. Open source practices are an efficient and often optimal mechanism for translating computational research, and TTOs are uniquely positioned to best facilitate open source practices at universities. To justify resources and measure success, this paper proposes a critical first set of metrics to track TTO activities and demonstrate impact.

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