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The 2022 State of Open Source in Financial Services

December 2022

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Foreword

Since we published the inaugural [State of Open Source in Financial Services](#) report in October 2021, a wave of acceleration in the adoption of open source has swept across **the Fintech Open Source Foundation (FINOS) community and the financial services sector**. Adoption not only in the sense of consumption of open source software, but the adoption of open collaboration and open governance as prime “coopetition” models for all industry constituents to drive their objectives. In tandem, the industry has made great strides in addressing long-standing interoperability and innovation challenges.

During the last 12 months, more than 20 financial institutions—on the sell side and buy side, and across commercial and retail banking—have established Open Source Program Offices (OSPOs), a fundamental pillar of mature corporate engagement in open source best practices. In the wake of [Log4Shell](#), **we saw the financial services industry react more swiftly and efficiently than any other industry** to address a potentially massive vulnerability, and for good reason, including amping up investments in global efforts, such as OpenSSF, to secure our software supply chain.

But it’s not just about financial institutions. In the last year, we also saw the rise of VC-backed commercial open source fintech startups like [Moov](#) or [OpenBB](#), and even [a16z](#), now openly talking about fintech as the next industry that open source will disrupt. Even [regulators across the world](#) are now acutely aware of the fundamental role that open source plays in financial services and beyond and are increasingly open to collaboration. Finally, established industry consortia and SDOs are now also [recognizing open source as the most viable option](#) to drive real adoption for their standards. Unquestionably, 2022 was the year in which we saw all the building blocks for an organic, growing, and sustainable

open community fall in place, with the wheels of innovation spinning faster and faster in our ecosystem.

This anecdotal evidence made me even more curious about this year’s report, which is our very first opportunity to quantify year-over-year growth of open source in the global financial services and fintech landscape. I was very pleased to see a significant increase in both the number of commits and the number of open source repositories financial services are actively engaged in, confirming that institutions are drastically investing in open source projects, and the perception of value continues to increase. These are only some of the headlines of what I think are a fantastic testament to the work and commitment across the financial services industry in general and the FINOS community in particular.

Having spent the last few years advocating for and evangelizing the industry on why and then how stakeholders should engage in open source, I can proudly and confidently say **that open source in financial services is here to stay**. I have no doubt that it will continue to revolutionize this industry as it has all other industries undergoing digital transformation.

I want to close by thanking our survey partners and, more importantly, our amazing FINOS and Linux Foundation contributors and members. Without their support, we would not be witnessing the significance and proliferation of open source in this industry. To everyone else, there’s a huge opportunity ahead of us, so if you are not yet part of this movement, **now is the time to join and contribute to the creation of the next generation of financial technology**.

Gabriele Columbro

Executive Director

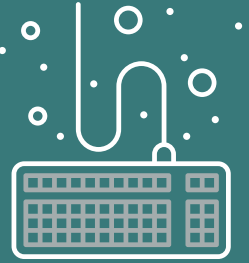
Fintech Open Source Foundation (FINOS)

Infographic: Open Source in Financial Services

87% of respondents agree that **open source is valuable to the future** of the financial services industry.



GitHub repositories with **commits from financial services institutions** are up **43%** over last year.



Fun and enjoyment are still **top reasons**

respondents engage with open source software.



56% agree that their organizations are getting **more value from open source** compared to 2021.



“Consuming open source software” and “using open source standards” were the **top factors increasing productivity**, with “inner source” close behind.



Open source consumption is encouraged in 48% of organizations, almost double the number from 2021.

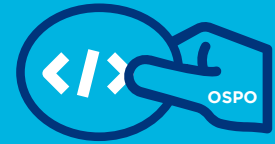


The ability for financial services employees to contribute to open source is up **75%** (20% in 2021 vs. 35% in 2022).



The number of financial services organizations **prohibiting open contribution** is down **70%** (6% in 2022 from 20% in 2021).

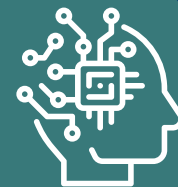
Organizations with OSPOs are just over twice as likely to openly encourage consumption



Organizations with OSPOs are almost **three times more likely to openly encourage contribution** than those without.



48% of respondents strongly agreed that **improving security** is a top reason their organization should contribute to open source. This is up from 28% in 2021.



Organizations with >10,000 employees have a greater breadth of open source consumption, with **use in AI, ML, data and analytics coming out on top.**

Executive summary

Last year, we produced the inaugural State of Open Source in Financial Services research report, which set a baseline for the understanding of open source aspirations, consumption, contribution, and leadership in the industry. Now, in our second year, we report on those same elements with additional insight into the changes during the last year. Further, we highlight obstacles and challenges that individual organizations, burgeoning communities, and the industry itself face. Here is a distillation of the key findings.

The industry is making more commits

While it is challenging to capture an accurate snapshot of the industry's actual code contributions, for reasons discussed in the report, a like-for-like comparison between contributions in 2021 and 2022 from financial services shows significant growth. This year, we found 41,277 repositories with financial services committers, which is an increase of 43% compared to last year's results. Commits also increased, albeit at a slightly lower level. The repositories were quite diverse in nature, including test frameworks, developer tooling, user interface toolkits and infrastructure code. Just over half of the code within the financial services dataset we evaluated is written in Java, compared to 11% in the entire GitHub corpus. Financial services firms have been dedicated users of Java for decades, with the language long being considered the de facto for "enterprise" development.

Signs point to a greater appreciation of the value of open source

Data in the report indicates that financial services leaders (both business and technology) are now more fully grasping the benefits of consuming open source—something long

known by most engineers—and even encouraging more contribution, particularly where there is an **OSPO**, or similar, in place. Over half (54%) of respondents shared that contributing to open source improved the quality of the software they were currently using and identified improved quality, a better workplace, stronger security, and fulfilling moral obligations as the top reasons that their organizations should contribute to open source. Active participation in open source is also cited as a key factor in recruiting and retaining IT talent.

Consumption is getting a lot of attention

The survey results show an overall positive sentiment toward open source, with 56% of respondents reporting that the value their organization derives from open source consumption has increased in the last year. A total of 48% of respondents also work in organizations that openly encourage open source consumption, which is a significant improvement (+21%) on last year. This positive trend, however, is not without challenges. Security is a clear and ever-present concern, as is decision-making regarding which components to use, when to update, how to manage license obligations, and more. It's also clear that open source consumption policy needs to be better coupled with tooling, education, guidelines, and more to increase its effectiveness. Survey respondents ranked the need for investment in operational issues, such as legal, compliance, security, and tooling, higher than the need to focus on the overall "value proposition" and "leadership."

Contribution could use more attention

The report shows that although the open source contribution story is positive, significant challenges remain, more so than for consumption. Despite the challenges, 38% of respondents reported being given more time to spend on open source contributions, and 64% of respondents stated that their organization maintains at least one open source project, with one third maintaining between three and 10 projects. There has also been a positive shift in open source policies, with a 75% increase (20% in 2021 vs. 35% in 2022) in contribution permitted under some circumstances and a 70% decrease (6% in 2022 from 20% in 2020) in the percentage of firms that do not permit contribution. Contribution to inner source projects remains higher, with respondents spending almost double the time contributing to inner source projects than to third party projects or projects that their own organizations open source.

Leadership is essential, challenging, and nuanced

In addition to work on policies, processes, and tooling, open source leaders in financial services must also deal with siloed workplaces, cultural differences, and potential misalignment between “the business” and technology. The survey results indicate that firms with an OSPO or visible open source leader, compared to those without, are better able to address these issues and far more likely to openly encourage both consumption (62% vs. 29%) and contribution (41% vs. 14%) while having a significant positive impact on employees’ perceptions of their organization’s engagement with open source. Leadership is nuanced, however, and our analysis suggests that while executive support is crucial, so too is a grassroots effort.

On balance, the findings of this report reveal that while consumption remains hard, contribution is even harder. At the same time, there is an increased appetite to overcome barriers and a growing number of open source leaders in the industry to help achieve this.

Introduction

Open source software is ubiquitous across industries, and financial services is no exception. While organizations actively engage in implementing open source technologies that are essential for day-to-day operations, on its own, open source strategy is under-heralded as a viable pathway to competitive advantage. At the same time, companies that dismiss open source as not competitively relevant do so to their detriment. The opportunities that open source creates for financial services organizations include lowering the total cost of ownership of IT infrastructure, increasing the time to market for digital applications, and keeping a competitive posture when it comes to talent recruitment and retention.

For all the benefits that open source creates, financial services firms face unique obstacles that preclude more fulsome participation in the space. In a similar fashion to the healthcare and public sectors, financial services organizations are bound—for good reason—by strict regulatory frameworks, where the cost of noncompliance comes in the form of punitive fines and damaged corporate reputations. Consequently, a cautious approach is often the order of the day when it comes to managing innovation, where internal policies concerning open source contribution can often range from outright prohibitive, at worst, to restrictive, at best.

The Fintech Open Source Foundation (FINOS) exists to provide guidance in navigating regulatory imperatives while enabling parties to realize the benefits of open source collaboration. In addition, FINOS aims to create a path to sustainable innovation, accelerating collaboration among a networked community of competitors, who have come together to solve common challenges and pain points, while enjoying a host of benefits.

FINOS comprises more than 64 member organizations who join together to innovate on open source software, open standards, and data technologies unique to the financial services sector, including in cloud services, financial desktop applications, and beyond.

Once again, FINOS, in partnership with Linux Foundation Research, launched a new study to understand the use of open source among financial services organizations, including banks, asset managers, and hedge funds. Working with GitHub, Red Hat, and Scott Logic, this new empirical research study was initiated with the goal of creating an industry-wide resource to be accessible by all financial services organizations to inform their open source strategy, with comparisons to the inaugural study published in 2021 to show directional trends.

This report explores and compares the current landscape of open source consumption, contribution, leadership, and governance in the financial services sector, focusing on how the industry has changed in a short amount of time. With insights from subject matter experts at leading organizations across the sector, the report sheds light on the strategic opportunities and organizational benefits created by open source as well as the challenges unique to the industry.

Scope of open source financial services activity

In this section, we explore the open source activities of financial services organizations through publicly available GitHub data. It is challenging to capture the full extent of open source interactions because as we highlight elsewhere in this report, policies and restrictions often push developers to use their personal account when interacting with GitHub. However, despite these challenges, we observe interesting patterns from the available data.

GitHub provided the analysis in this section using a list of FINOS-supplied email domains of over 400 of the largest financial services institutions (by revenue and/or assets under management) as well as those financial services organizations known to this group to be active or interested in open source. Data was included for GitHub users who made commits to any public repo with a primary email that matched an email domain in a FINOS-provided list or if the user was a member of an organization that had a billing email with a domain in that same list.

This year, as shown in **TABLE 1**, we find 36,107 repositories with financial services committers, which is an increase of 43% compared to last year's results. Elsewhere in this report, we highlight that contribution policies are shifting toward a more favorable position. Contribution is more often permitted in 2022 (35% vs. 20%), with the increased activity we observed within GitHub likely reflecting this positive policy change. We see a similar, yet more modest, increase in the total number of financial services personnel interacting within GitHub.

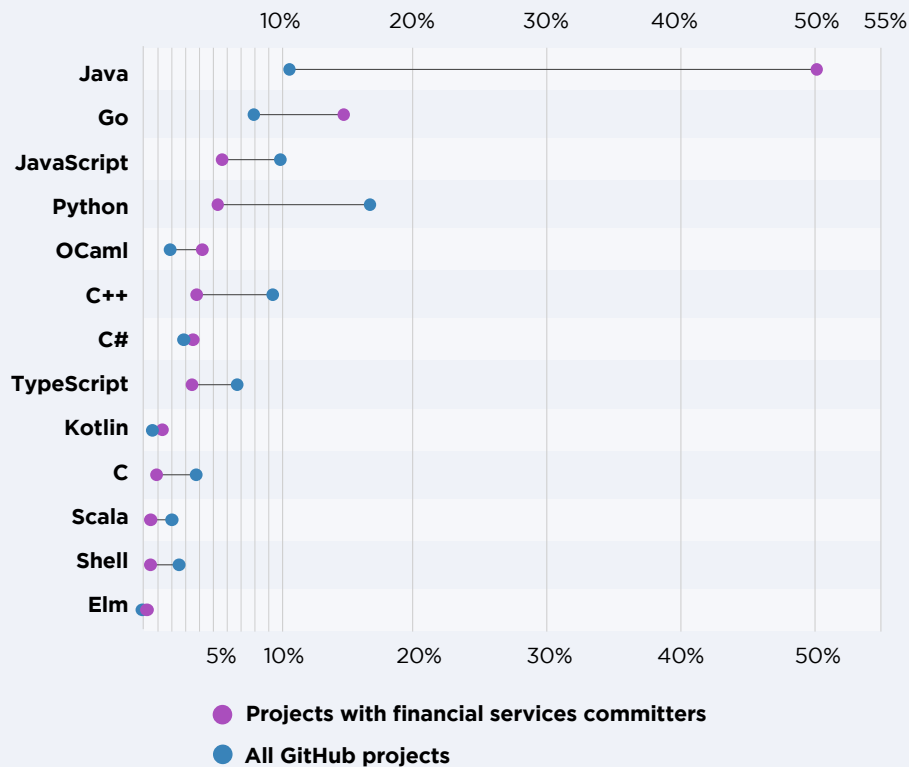
The goal of FINOS is to drive collaboration within the financial services industry. With that in mind, it is interesting to see how often multiple financial institutions are active in a single repository. Last year, we found that most projects in the dataset had contributors from only a single financial services institution. This year, this figure has increased to 41 projects, with committers from more than one financial institution compared with 24 last year.

TABLE 1
GitHub repositories with a financial services email domain

Year	Unique repositories with FinServ commits	Unique FinServ users	Total commits by FinServ users
2022	36,107	8,552	535,974
2021 ¹	25,280	6,857	429,258

FIGURE 1

A comparison of the most widely used languages in financial services



SOURCE: GITHUB, OCTOBER 2022

If we instead look at collaboration on the individual level, there are 357 open source repositories in the dataset with two or more financial services committers (that may be from the same financial services institution). Some of the most active repositories in this dataset include:

- `jpmorganchase/uitk`—a JPMorgan project that provides a suite of user interface (UI) components and a flexible theming system.
- `finos/kdb-studio`—a FINOS-hosted project that provides an interactive environment for working with the KDB database.
- `todogroup/governance`—a project relating to the governance of TODO Group, a Linux Foundation organization that promotes open source best practices through OSPOs.
- `man-group/arctic`—a Man Group-hosted project that provides a high performance datastore for time series and tick data
- `finos/morphir-jvm`—a FINOS-hosted project that provides tools to work with the Morphir IR on/using the JVM.
- `manulife-ets/dvna`—Damn Vulnerable NodeJS Application (DVNA), a NodeJS application to demonstrate OWASP Top 10 Vulnerabilities, to aid testing and security research.

The above are quite diverse in nature, test frameworks, developer tooling, UI toolkits, and infrastructure code. Notably, there are several FINOS-hosted projects among the most active. The datasets also show alignment with the survey results, where respondents reported that their organizations were predominantly contributing to projects relating to web app development, cloud and containerization technologies, AI/ML, and CI/CD.

For these 357 projects, we used the GitHub API to download further metadata, allowing us to create a profile of the projects that financial services employees contribute to.

The GitHub API provides detailed statistics regarding the programming languages used in the development of open source projects, providing a lines-of-code count for individual languages. By summing this across the entire dataset, we can see the most prevalent languages within the projects that financial services employees commit to (which is a likely indication of the languages these employees are using themselves). We can also compare this to the publicly available data for the entire GitHub corpus.

FIGURE 1 shows us that 51% of the code within the financial services data set is written in Java (compared to 11% in the

entire GitHub corpus). Financial services firms have been a dedicated user of Java for decades, with the language long being considered the de facto for “enterprise” development. The next most frequent language is Go, which is a surprising result, as it isn’t often associated with financial services.

GitHub has a mechanism for adding topics to repositories, which are free-text input (it guides users toward existing topics where appropriate). We combined the topics for the 357 projects in order to determine the most popular across the dataset.

The most popular topic is spring-boot, which relates to Spring Boot, a modern Java application development framework. The next most popular topics were all language related; JavaScript, Python, and WebAssembly.

FIGURE 2
The most popular topics added to financial services GitHub repos



GENERATED VIA GITHUB DATA

Survey and interview findings

Value proposition

There are several benefits to open source software, including increased agility and innovative technical capabilities.

Through survey results and personal interviews with individuals in global financial institutions, we explore how respondents are motivated to leverage open source and how it impacts not only their technology, but also people and productivity while remaining secure and compliant. In addition, we review aspirational opportunities in the open source journey.

MOTIVATORS

Financial institutions need to rapidly modernize their technology function to support the digital transformation of both the front and back ends of their businesses. Enterprises are increasingly turning to open source technologies for business-critical work involved in their digital transformation strategies. There are several benefits to open source software, such as cost savings, increased agility, and innovative technical capabilities.

According to Gil Yehuda of U.S. Bank, “Open source has been strategic for the organization.”² He also says, “In general, some financial services organizations viewed technology as something you purchase versus a strategic component to their business growth. We’re now seeing technology decisions as being strategic to business for more firms.”

More broadly, however, this tells us that financial services leaders are starting to understand the benefits of consuming open source—especially when open source does not

differentiate the organization, nor does it provide an obvious competitive advantage. Unlike proprietary software, open source technologies are customizable and scalable to adjust and modify to the business’s needs. Starting a project from scratch simply isn’t necessary when there are a wide variety of secure open source packages.

In the words of one OSPO leader, “We’re not going to differentiate ourselves in the marketplace by making a container orchestration system.”³ However, many institutions need container orchestration tools to automate the deployment, networking, scaling, and management of containers. Open source enables faster time to value if one is already shared in the open for all to use and modify through collaboration.

Balancing out the consumption of open source software for internal projects includes contributing to open source by getting involved in upstream projects and communities. Contributing to open source software helps institutions to understand that the foundational technologies for their businesses are secure. An added benefit of contribution is the ability to reduce technical debt by relying on publicly maintained versions.

The challenges that most organizations face aren’t only technological. The problems can lie in how teams operate either together or singularly. Structuring collaboration is a significant step in organizing how innovation occurs around the organization’s choice to leverage open source software and its principles. This can be a challenge within siloed organizations.

ORGANIZATION AND CULTURE

Market demands are pushing organizations to rethink some truly fundamental notions and in some cases, prompting them to reconsider how they operate. Openness is becoming increasingly central to how groups and teams of all sizes are working together to achieve shared goals. **FIGURE 3** shows that over half (54%) of respondents report that contributing to open source improved the quality of the software they are currently using.

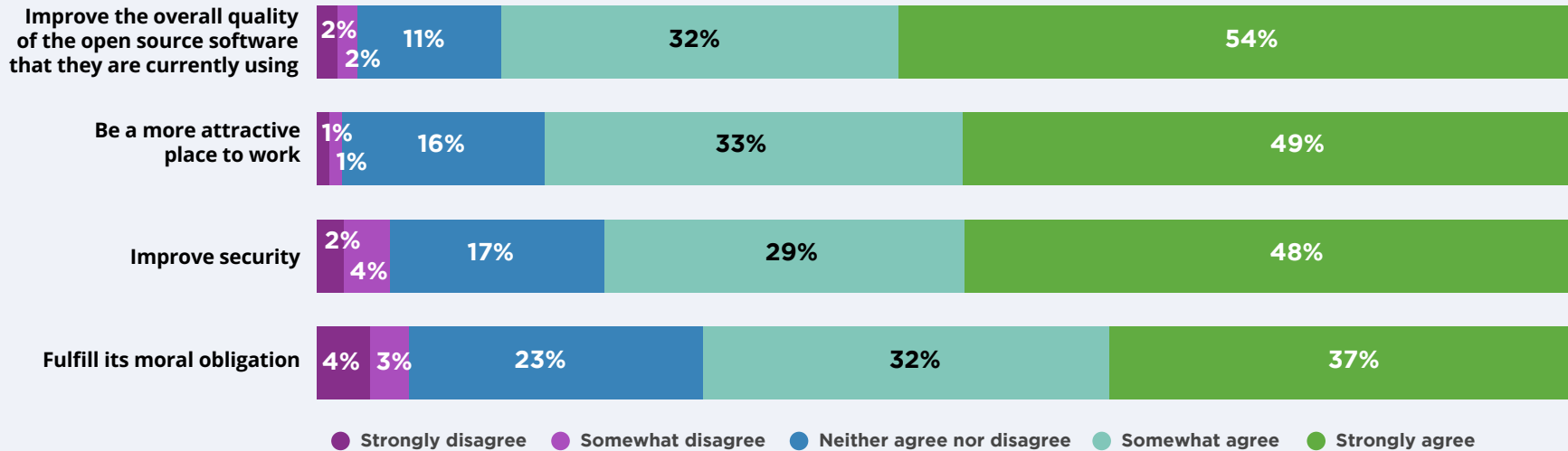
Technology alone isn't enough to sufficiently tackle any set of challenges. Doing the same things with different tools isn't an effective strategy for change. Another approach incorporates people and practices within the platforms.

By actively participating in open source, organizations demonstrate that they invest in supporting talent. Organizations can also interact with potential hires in the project's community and get a preview of how prospective candidates engage with others, leading to both better fits in the hiring process, and aiding in talent retention.

When asked how open source efforts fit into how their firm recruits and retains IT talent, one global technical architect shared, "Talent recruitment is HUGE for us. We purposely publish our APIs to a lot of projects for contribution but also for talent acquisition."⁴ Another senior technologist shared a similar view: "Being part of the open source community is

FIGURE 3
Organizational reasons for contributing to open source

I feel my organization should contribute to open source in order to:



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q26, SAMPLE SIZE = 188-193, DKNS EXCLUDED

particularly important for hiring. We want our staff to be part of that community. It's well understood that it has become an essential element for hiring and retention.”⁵

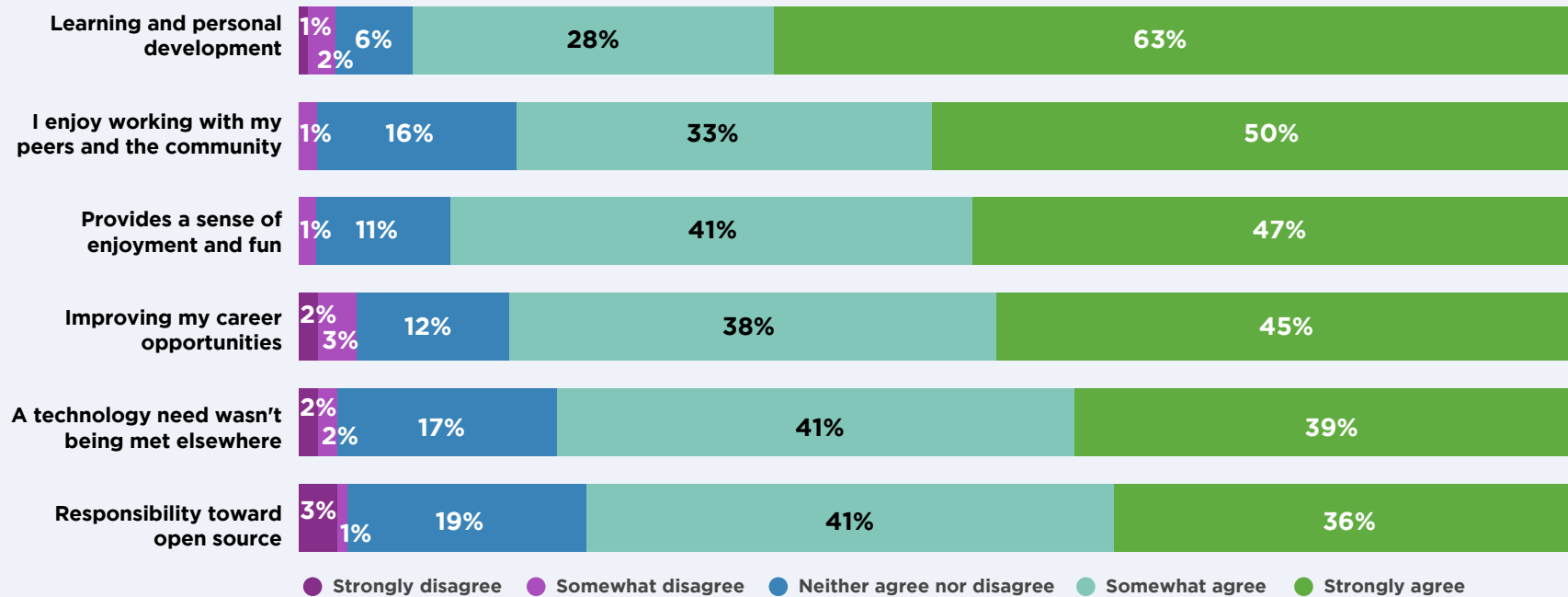
In **FIGURE 4**, respondents reveal how influential the following factors are when considering contributing their time to OSS. The majority (63%) identify the importance of learning and personal development. Half (50%) say that working with peers has an influence on whether or not to contribute, followed by enjoyment and fun (47%) and improving career opportunities (45%).

Recruiting and retaining qualified talent is a benefit expressed by many of our interviewees when asked to evaluate the merits of employee contributions to open source. One engineer says, “Our ambition to be a big digital player isn’t going to be met if we can’t retain the right talent. Amongst many of the really good engineers there is a desire to contribute to open source for their own reward and recognition but also that feeling of giving back.”⁶

Organizations that are typically active in open source project communities recognize that the users or consumers of their

FIGURE 4
Factors that influence contributions to open source

How influential are the following factors when considering whether or not to contribute your personal time to OSS projects?



firm's technology stack, such as developers, engineers, and architects, are stakeholders in the organization's success. Retaining these stakeholders and growing their skills is a key opportunity to stay competitive in today's market.

In thinking of your organization, how many are innovative, engaged, and producing outcomes that were not previously seen?

SECURITY

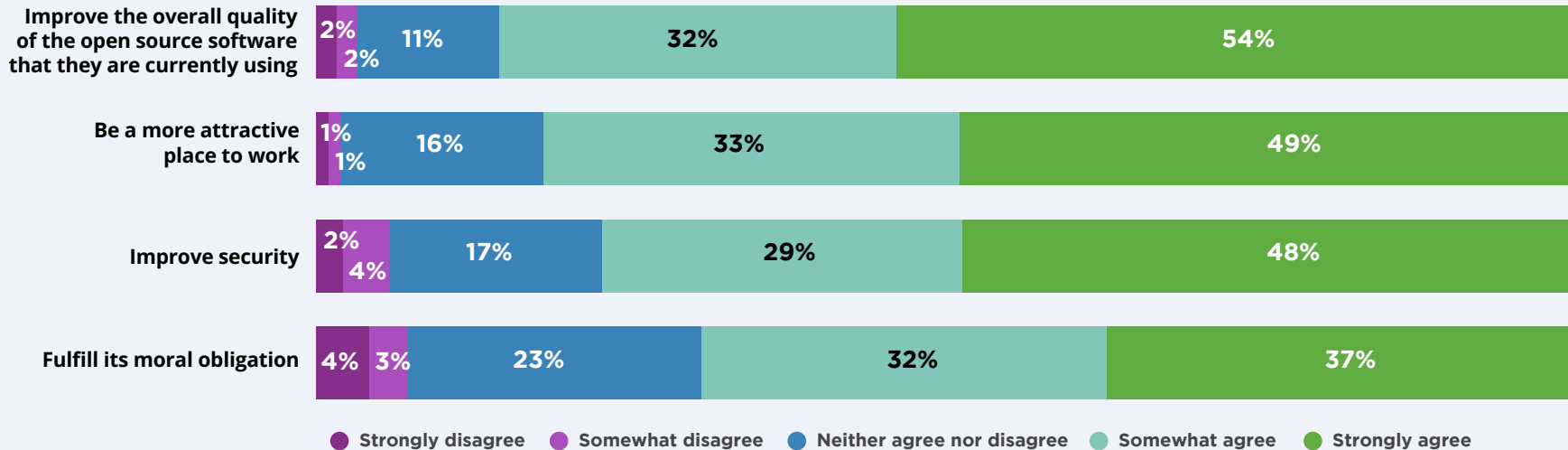
Financial institutions want the innovative benefits of open source without the risks—that is, with the promise of

reliability, support, security, and a more predictable release cadence. The challenge for leaders in financial services is ensuring that they are taking full advantage of all the innovative potential of open source in a way that does not impede developers or put the organization at risk. This being said, as **FIGURE 5** below shows, 77% of survey respondents report that contributing to open source software improves the security of the projects they are working on (48% strongly agree, and 29% somewhat agree).

Due to regulatory, compliance, and security reasons, certain open source communities might not be the right place to

FIGURE 5
Organizational reasons for contributing to open source

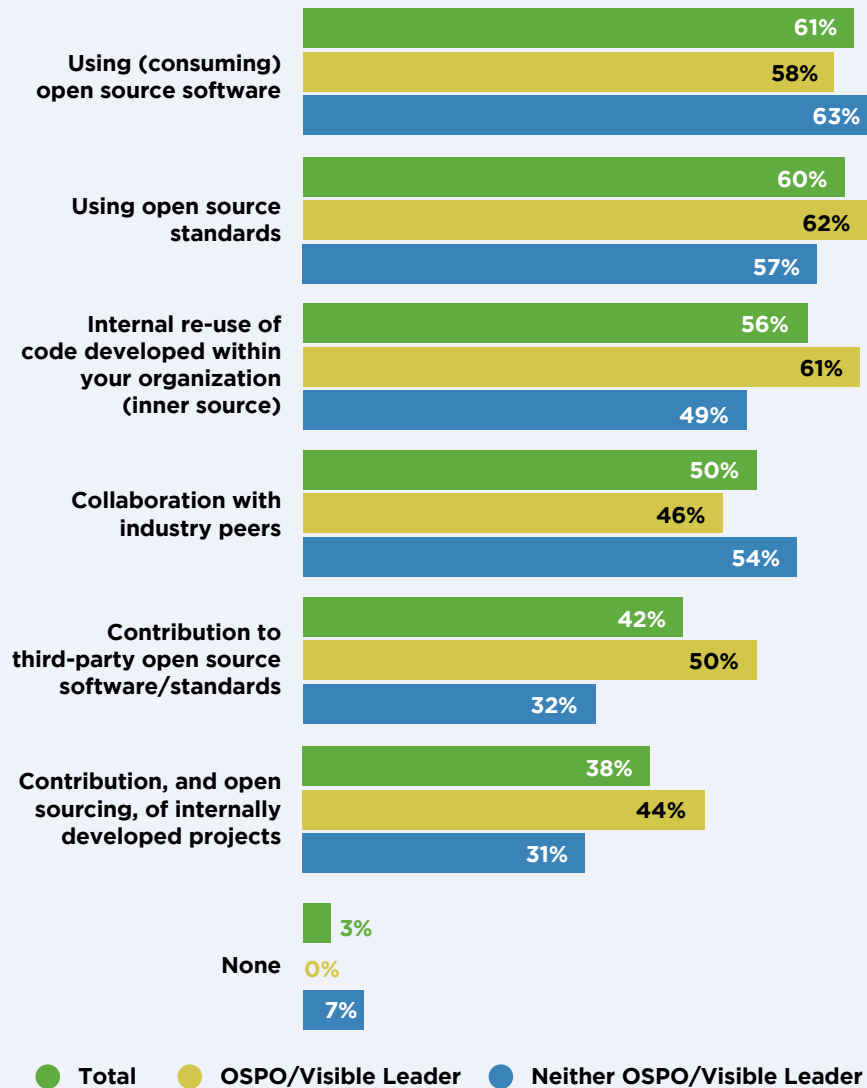
I feel my organization should contribute to open source in order to:



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q26, SAMPLE SIZE = 188-193, DKNS EXCLUDED

FIGURE 6
How open source increases productivity

Which of the following increases your productivity at work? (check all that apply) Segmented by OSPO/Visible Leader



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q36, SAMPLE SIZE = 196, VALID CASES = 196, TOTAL MENTIONS = 6

contribute or consume code. By creating an internal infrastructure using standard tools, policies, and processes, consumption and contribution becomes easier, more secure, and more compliant compared with the ad hoc approaches to modernization and transformation that are being carried out in many institutions today.

ASPIRATIONS/OPPORTUNITIES

By licensing code in an open way and collaborating with industry peers to build it, there are communities of people all working toward the same goal. They are collaborating to build better solutions rather than working on individual or proprietary projects behind a wall. Everyone shares the same points of reference and shares in the success of the project because work is transparent and accessible to all.

We have discussed organizational approaches that aim to create more agile, innovative, and collaborative teams that act with purpose and generate value more quickly. It is not one size fits all; different organizations require different techniques such as an innersource development model.

Innersource uses open source software development best practices and the establishment of an open source-like culture within organizations to develop non-open source and/or proprietary software. As one interviewee describes, “We just launched our innersource program, and we have a few projects as inner source ready and created a process through a Jira intake.”⁷

The connection between innersource, open source, and leadership is a meaningful one. As **FIGURE 6** shows, 61% of respondents shared that their inner source goals improved with a visible OSPO leader within their organization.

As organizations embrace open operating principles alongside open source tooling, ensuring those goals are outlined in

a coordinated, formalized corporate strategy or road map(s) is important. As **FIGURE 7** presents, this year's survey shows that 43% of respondents strongly agree, and 36% somewhat agree that their organization's contribution to open source would increase if it focused on the value proposition that open source holds for their organization.

Organizational Consumption

In this section, we focus on the consumption of open source within organizations. This means the use or incorporation of open source code, components, and tools in the creation and operation of an organization's digital products or services. Here we find that:

- A total of 48% of respondents work in organizations that openly encourage open source consumption, which is a significant improvement (+21%) over last year. See **FIGURE 8** below.

- Open source consumption policy needs to work alongside tooling, education, guidelines, and more to be effective.
- Organizations have a surprising level of confidence in the quality of the open source components they consume.
- Open source is used widely for a great variety of purposes. However, for the largest of organizations, its use in AI/ML and data and analytics, is most prominent.
- There is a wide range of motivating factors for increasing open source consumption, which suggests that OSPOs and open source leaders need to exhibit equal breadth in their leadership.

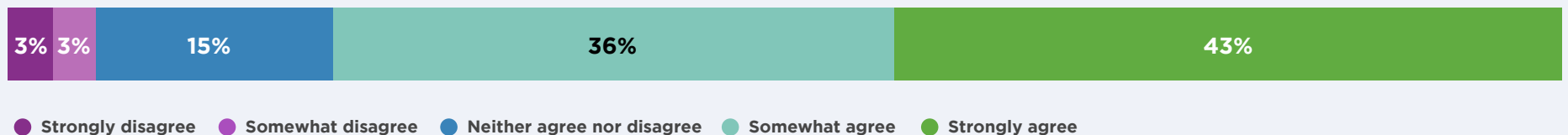
ORGANIZATIONAL POLICY ON OPEN SOURCE CONSUMPTION

The software industry has generally embraced open source, with multiple reports indicating that open source has become a dominant force. The recent Census II report⁸ from Linux

FIGURE 7

Education as an influencing factor for increased contribution to OSS

My organization's contribution to OSS would increase if it focused investment or effort on organization-wide education on the value proposition.

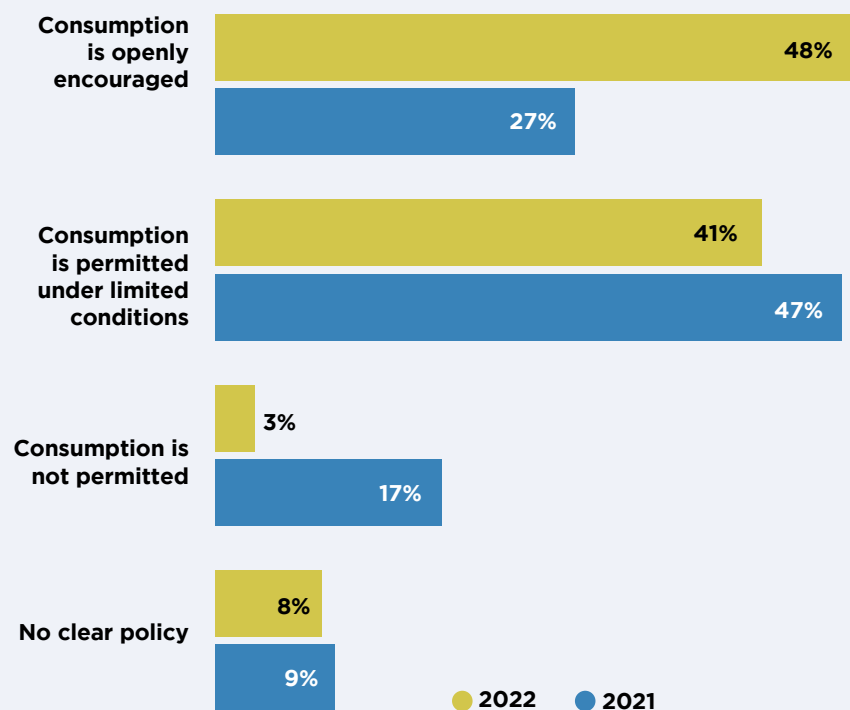


2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q28, SAMPLE SIZE = 191, DKNS EXCLUDED

FIGURE 8

Comparison of the extent to which open source consumption is permitted at the respondents' organization

What statement is closest to your current organization's policy on open source consumption? (select one)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q12, SAMPLE SIZE = 210
2021 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q21, SAMPLE SIZE = 111

Foundation Research estimates that open source software constitutes 70 to 90% of any given modern software solution. In the words of one interviewee for this report, “It would be hard to find code today that does not have some dependency on open source.”⁹

Notably, much of the infrastructure that public cloud vendors provide is itself open source; hence, by using the public cloud, we are indirectly consuming open source code.

“In engaging cloud service providers and vendors to give us things like a load balancer, a data store, a virtual machine, for example ... since they are running open source software, so are we.”¹⁰

The widespread use of open source is a positive result for the software industry, where both the community and enterprises benefit from the collaborative creation of shared value. However, it is not without challenges. Security is a clear and ever-present concern, as is decision-making regarding which components to use, when to update, how to manage license obligations, and more.

The first step toward tackling these challenges is to have a clear and effective policy relating to the consumption of open source software and components. We explored organizational consumption policies, with the results shown in **FIGURE 8**.

As indicated in the above figure, this year's research shows that 48% of respondents work in organizations that openly encourage open source consumption, which is a significant increase compared with last year's results (27%). This is a very positive result for financial services, which has been slow to adopt open source compared with other industry sectors. However, there is still room for improvement. A recent survey that spanned multiple sectors found that 57% of respondents work in organizations that openly encourage open source consumption.¹¹

Therefore, it is likely that the volume of consumption is increasing, as is the value derived from open source. **FIGURE 9** shows that our survey reflects this overall positive sentiment, where 56% report that the value their organization derives from open source has increased this year.

“The value of open source is apparent and obvious due to its ubiquity. The difficulty is in expressing the value of contribution.” —Executive director of a global bank

PUTTING POLICY INTO PRACTICE

Open source consumption is a complex process. A written policy, no matter how well formed, is simply not enough. A whole range of other activities and artifacts must support it. In our survey, we asked how organizations turn open source policy into practice. **FIGURE 10** shows the results.

We see a diverse set of responses across tooling, education, formal processes, and guidelines. All these activities and artifacts play an important role. According to NatWest’s Jonathan Haggarty, Head of Bank APIs Technology, “The

breadth of dependencies is so large; there is no way to manage this without automation and a “group think” across the entire ecosystem. The solution has to be part of the Software Development Lifecycle, it has to be baked-in. Anything relying on manual intervention is destined to fail.”¹²

While open source has tremendous value, which policy and tooling can help organizations to unlock, it is not without risk. There have been a number of high-profile security incidents relating to critical open source components recently (e.g., Log4Shell), which have resulted in equally high profile initiatives to address these challenges. There has also been an increased interest in the use of standards such as Software Bill of Materials (SBOMs) across the overall software supply chain, which is an acknowledgment that both are becoming increasingly complex. The software supply chain was the topic of a recent White House briefing, which highlighted the critical role it plays in protecting a nation’s cybersecurity. While it wasn’t mentioned explicitly, the “supply chains” that are being referenced will most certainly contain a *lot* of open source code.

FIGURE 9

Comparison of the perceived change in the value organizations have derived from open source over the last year

Over the last year, the value that your organization is deriving from open source consumption has: (select one)

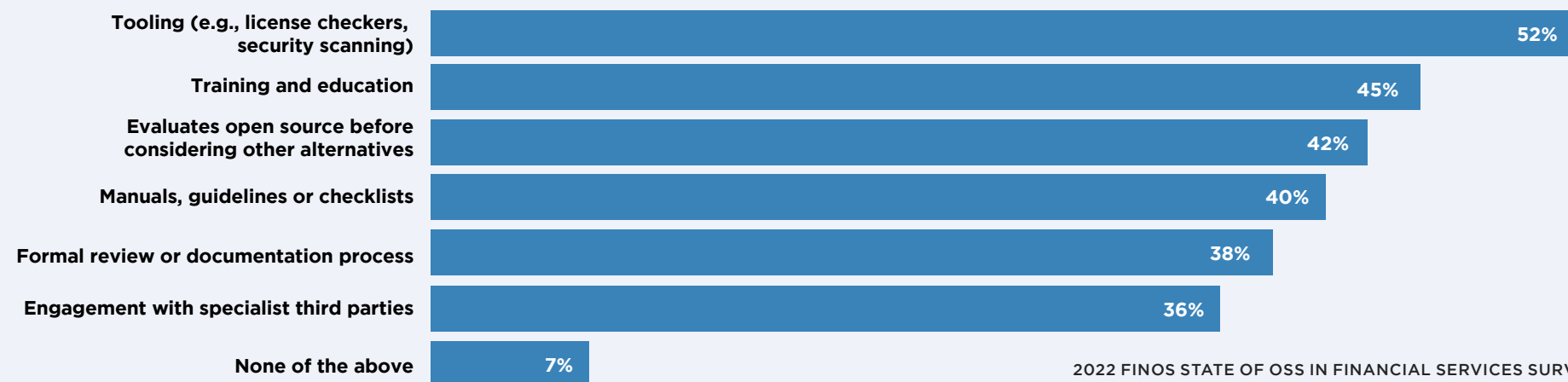


2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q16, SAMPLE SIZE = 210

FIGURE 10

How organizations turn open source policy into practice

How does your organization turn open source policy into practice? (check all that apply)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q13, SAMPLE SIZE = 210, VALID CASES = 210, TOTAL MENTIONS = 547

CONSUMING WITH CONFIDENCE

FIGURE 11 shows the level of confidence respondents have in the open source components they consume. We find that 69% of organizations overall are confident (either extremely or somewhat) that the components they consume are maintained and up to date. This is an increased level of confidence compared with last year's results (where only 19% were extremely confident versus 33% this year).

This high and increasing level of confidence is quite surprising, especially considering recent events. We looked at how responses to this question varied between technical and nontechnical roles, and as FIGURE 11 shows, that 28% in technical roles are extremely confident (that components they consume are up to date and maintained), compared with 38% in nontechnical roles reporting the same. This finding echoes a recent report from Sonatype that uncovered a positive bias

from those in managerial roles. Furthermore, the Sonatype study demonstrated this to be an overexpression of confidence, by revealing that the open source components some people are confident in had known vulnerabilities.

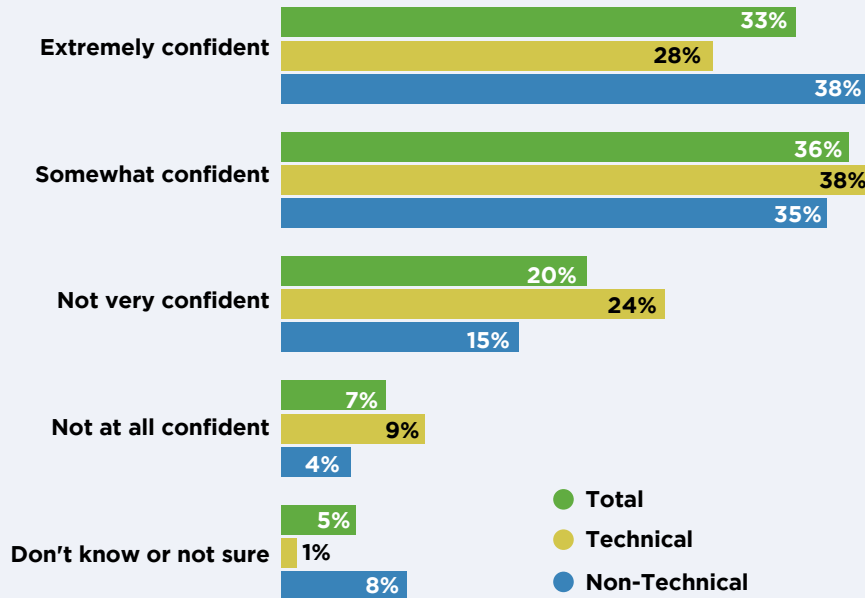
“We leveraged the demographic data collected during the survey and broke down the results by job title. The findings were illuminating. There is an ongoing bias toward seeing things in a better light, in which managers report higher stages of maturity compared to what is reported by other roles. Survey-wide, this discrepancy is statistically significant when comparing IT managers and those working in information security roles.”¹³

Counter to the confidence expressed by survey respondents, the interviews we conducted revealed a much more measured response. There is an ever-growing awareness of security,

FIGURE 11

Organizational confidence in the open source components they consume

How confident are you that the open source components you use are maintained and up-to-date? (select one) segmented by: Which of the following most closely describes your role?



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q14 X Q9, SAMPLE SIZE = 210

supply chain issues, and the overall maintenance challenge of open source software. As a result, organizations, such as OpenSSF, are growing in membership and creating concrete plans to tackle these challenges. NatWest's Haggarty states, "Log4j will result in a sea change. People will think twice about what this means—it is starting to knock confidence."¹⁴

IN THEIR WORDS

Financial services leaders on security

"Cybersecurity and supply chain are now top of mind in a way they weren't 20 years ago. Particularly as a regulated entity, we have to be sure that we are secure."¹⁵

"We have tight inbound controls for open source consumption. We also focus on controls for software that is in production, which is vital for any organization with a large legacy estate."¹⁶

"We have had an increased involvement in OpenSSF, attending meetings and helping to guide that project. It's better for the world. It's for the greater good."¹⁷

"In the first few hours of the Log4J, the vulnerability was reported by someone from a major company, basically saying, let us know when it's fixed. I would love to think I could have been asking, 'How can I help with this?' rather than just 'Tell me when it's fixed.'"¹⁸

WHERE IS OPEN SOURCE USED?

Open source consumption is occurring on a massive scale. According to Elspeth Minty, Managing Director at RBC Capital Markets, "Open source is used in some form in around 90% of systems. If you include tooling around compilers and runtime and builds and deployment, it's 100%."¹⁹ Another leader who we spoke to detected around 35,000 different open source components, with 128,000 versions of those components.

The survey explored where open source is used, with the results shown in **FIGURE 12**. More than half of the respondents are aware of their organizations using open source software for cloud/containerization, web application development, CI/CD and DevOps, AI/ML and data and analytics. However, it is likely that this is simply a reflection of the innovation happening in these particular fields, resulting in increased visibility within the organization as a whole.

We also find that larger organizations (more than 10,000 employees) have a greater breadth of open source consumption, with its use in AI/ML, data, and analytics coming out on

top, as shown in **FIGURE 13** below. Large organizations have vast quantities of data, often distributed across numerous silos. There is a tremendous amount of value “locked up” in this data, hence the interest in open source tools that can unlock the stored potential.

While it is impossible to list all of the open source projects used within financial services, several were frequently mentioned in our interviews and should likely be considered “core” open source projects. These include Java Spring, Spring Boot, React, Apache Kafka, and Apache Cassandra.

FIGURE 12
Types of open source software in use

In which of the following areas does your organization use open source software? (check all that apply)

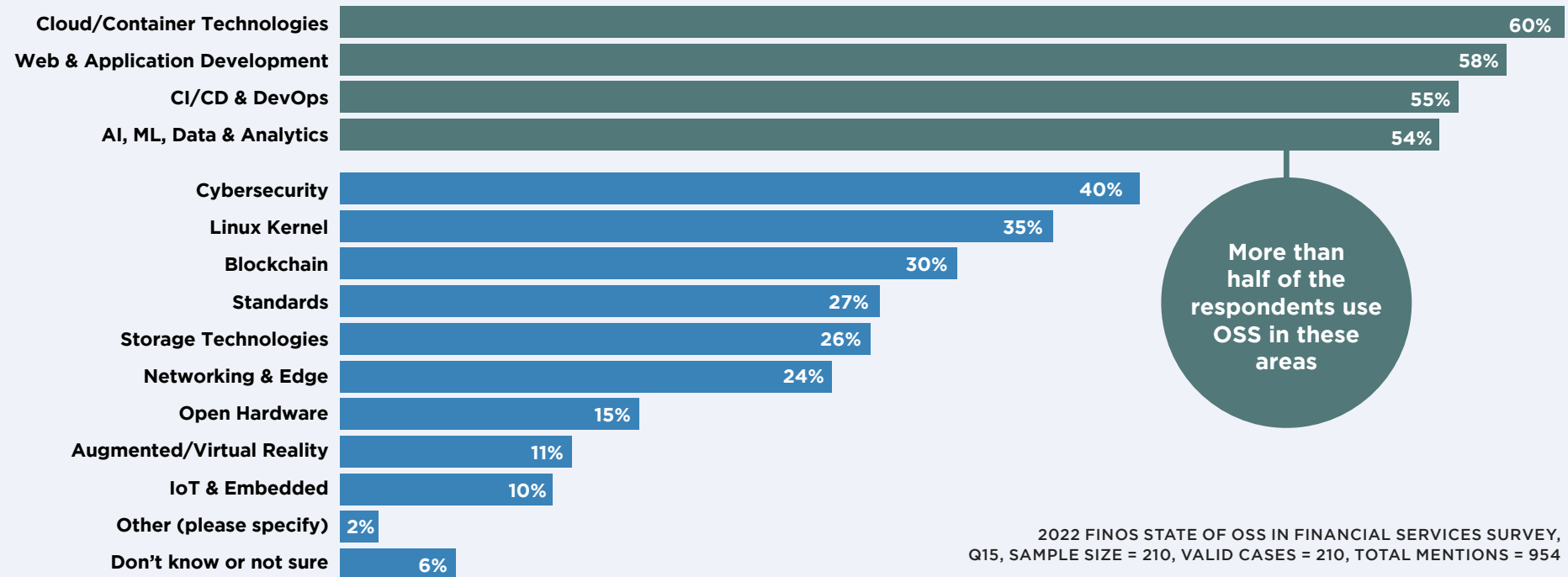
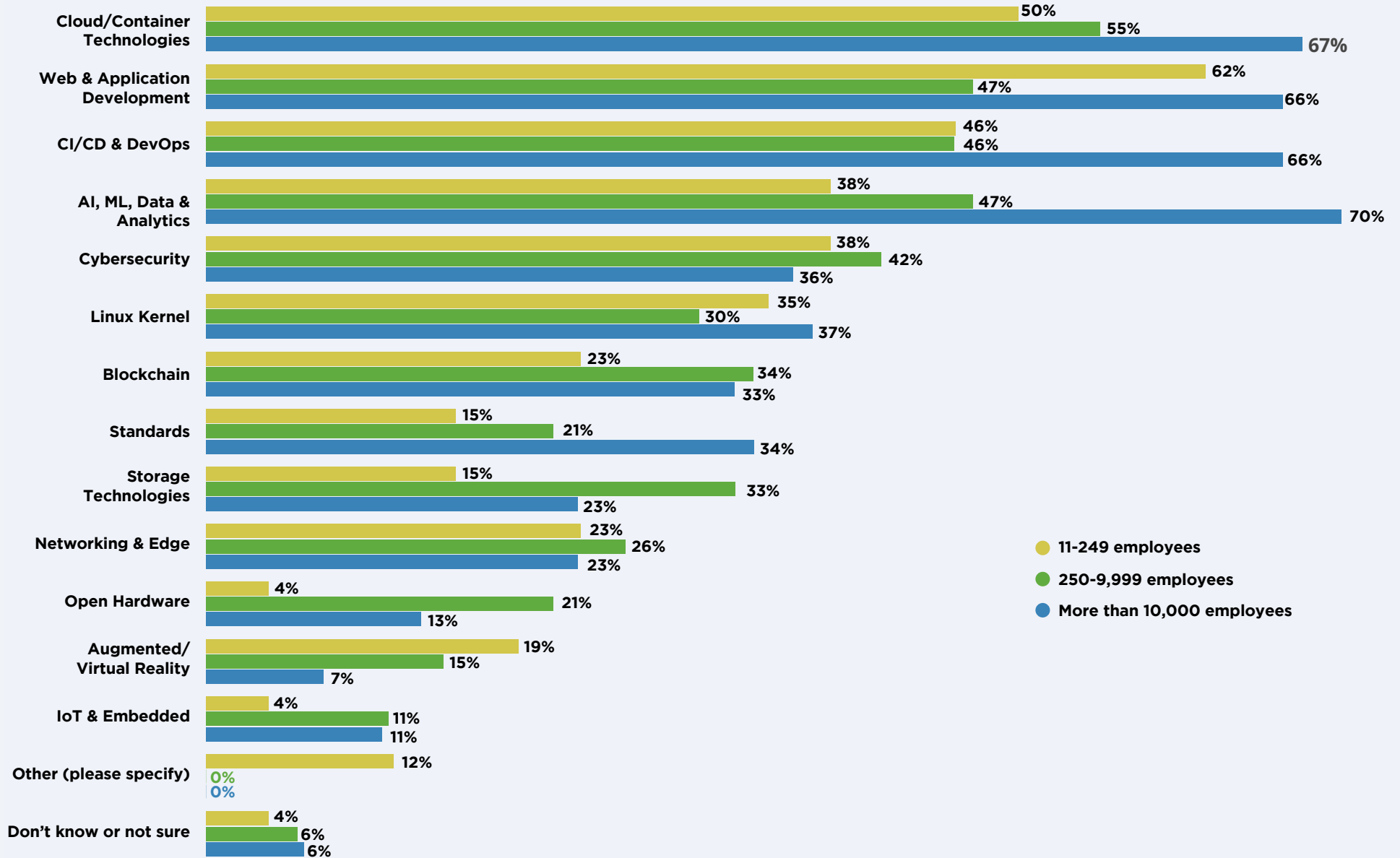


FIGURE 13

Types of open source software in use by organization size

In which of the following areas does your organization use open source software? (check all that apply) segmented by: How many employees the organization has worldwide



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q15 X Q7, SAMPLE SIZE = 209, VALID CASES = 209, TOTAL MENTIONS = 953

CONSUMPTION OPPORTUNITIES AND CHALLENGES

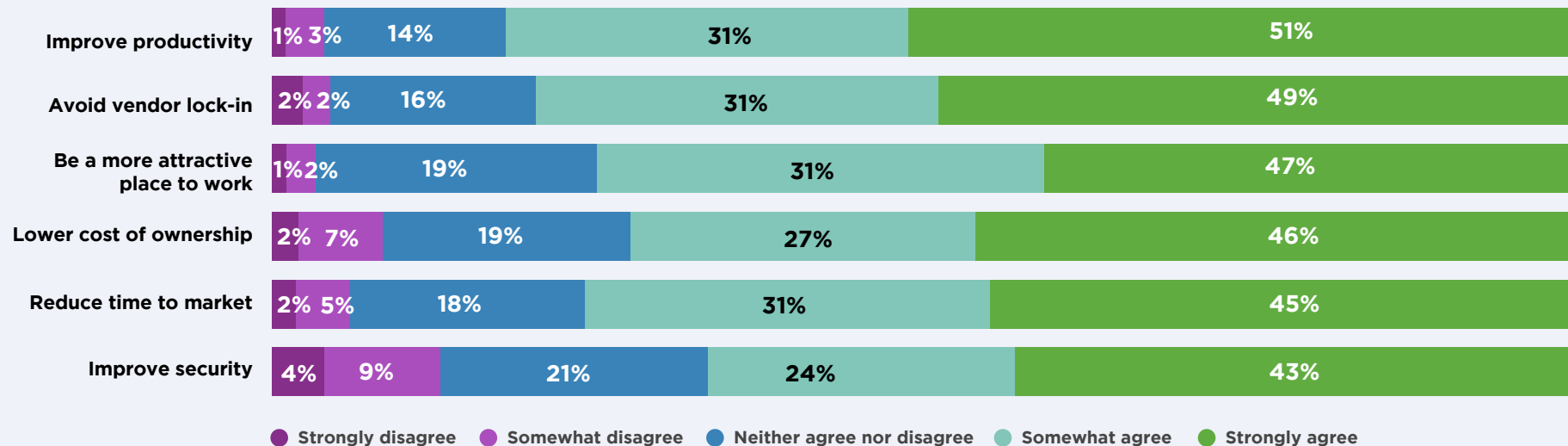
Our survey explored a broad range of motivators, challenges, and opportunities relating to open source consumption. We asked about the primary motivators for increased open source consumption, with the results shown in **FIGURE 14**. The primary reason cited for increasing consumption is to improve productivity, although this was by quite a slim margin, followed by “avoid vendor lock-in” and to make their organization an “attractive place to work,” with just 4% between the positive sentiment expressed for these three answers. Notably, most of the answers had a strong positive sentiment, indicating that there is a breadth of positive reasons to adopt open source software.

Briefly exploring the specifics, the productivity benefits of open source software are apparent. There is a great wealth of quality open source software available for free. Modern software development is just as much about sourcing and assembling suitable components as it is writing new code from scratch. Building on solid open source foundations is clearly a much more productive way to create software and business value.

Regarding vendor lock-in, an equivalent question in a survey targeted at a cross-industry demographic within Europe showed that this was a leading motivation by a significant margin (13% greater sentiment than the next highest). Vendor lock-in refers to the situation where you are essentially

FIGURE 14
Motivating factors that increase the consumption of open source

My organization should increase its consumption of OSS in order to:



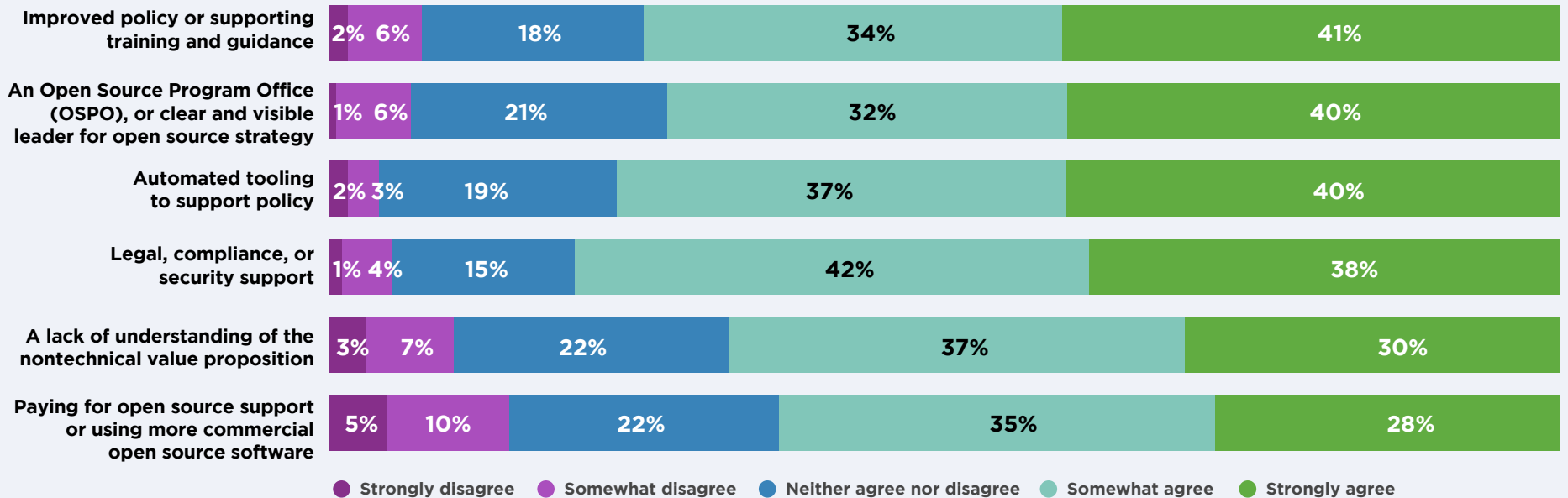
stuck using a particular product or service, regardless of the quality, because switching away is not practical. Open source is a mitigation for this risk, as its openness inherently creates alternative provision routes and typically eases migration if switching. This is clearly less of a perceived risk within financial services, perhaps a reflection of the strong “buying power” these organizations have compared with smaller organizations in less tech-at-core sectors (e.g., public sector or education).

There are several obstacles and challenges that affect an individual’s or team’s ability to consume open source

software. Our survey asked what investments respondent’s organizations could make to clear some of these obstacles, with the results shown in **FIGURE 15**. The area that requires most investment is “legal, compliance, and security,” closely followed by “tooling.” Interestingly, the need to invest in the overall “value proposition” and “leadership” was relatively low in comparison, which suggests that the challenges are more operational than strategic in nature. The industry still has a long way to go to make the collective vision of embracing open source a reality. From speaking with interviewees, the general sentiment is that open source consumption is still hard, but contribution is harder.

FIGURE 15
Areas of investment that increase the consumption of open source

My organization would increase OSS consumption if it focused investment or effort on:



IN THEIR WORDS

Financial services leaders on consumption

“Consumption for our organization is fairly open. We track and validate against licenses we can contribute to. We track everything that we consume into our company repositories. As long as it is a known license, then users can download. This way we can track for potential vulnerabilities.”²⁰

“Consumption is bifurcated. Dependency requests through our internal repository is a fairly seamless SE scan, file, and exception. There are established policies around licenses to use. There is clearance to use any contribution if it meets licensing requirements. To put into production, not just used in a sandbox, there is a technology selection process that goes to the review board.”²¹

Organizational Contribution

As described in the previous section, the vast majority of financial institutions have a policy on open source consumption; however, successfully and robustly implementing those policies at scale is complex. When it comes to contribution, it is even more complicated and can be quite prohibitive.

For clarity, our survey and this report include a number of different activities in the definition of open source contribution. These are:

- Sending any changes made to an open source project back to the original maintainers for inclusion into upcoming releases.
- Submitting patches or pull requests to open source projects.
- Opening issues and taking part in online discussions relating to open source projects.

In this section, we look at open source contribution and find the following:

- Financial services organizations face significant challenges to open source contribution and lag other industries.
- Despite the challenges, 74% of respondents indicate that there are processes to release code outside their organization, and there has been a 75% increase (from 20% in 2021 to 35% in 2022) in firms permitting open source contribution.
- A total of 64% of respondents say their organization maintains at least one open source project, and 33% say they maintain between three and 10 projects.
- Respondents spend almost double the time contributing

to inner source projects than to third-party projects or projects that their own organizations open source.

CHALLENGES TO OPEN SOURCE CONTRIBUTION

Financial institutions face significant challenges in enabling and monitoring all types of contributions. It is important to understand these as we look at the highly regulated industry's progress in increasing contributions to open source projects and standards.

As our 2021 report discusses, open source policies must address legal, compliance, security, and intellectual property concerns while acting as enablers for their employees.

They should identify training and resources available to employees, clearly describe the requirements or restrictions, and lay the foundation for critical processes and tooling that automate and simplify adherence to the policies. It is also essential to find the best and most efficient ways of promoting the policies themselves, which is no easy task given the large amount of information individuals receive every day.

While we are seeing an increase in the number of financial institutions with contribution policies, there are still numerous factors impeding these organizations' abilities to make open source contributions. As **FIGURE 16** shows, over

FIGURE 16
Factors limiting an organization's willingness to contribute to OSS

My organization would increase OSS contribution if it focused investment or effort on:

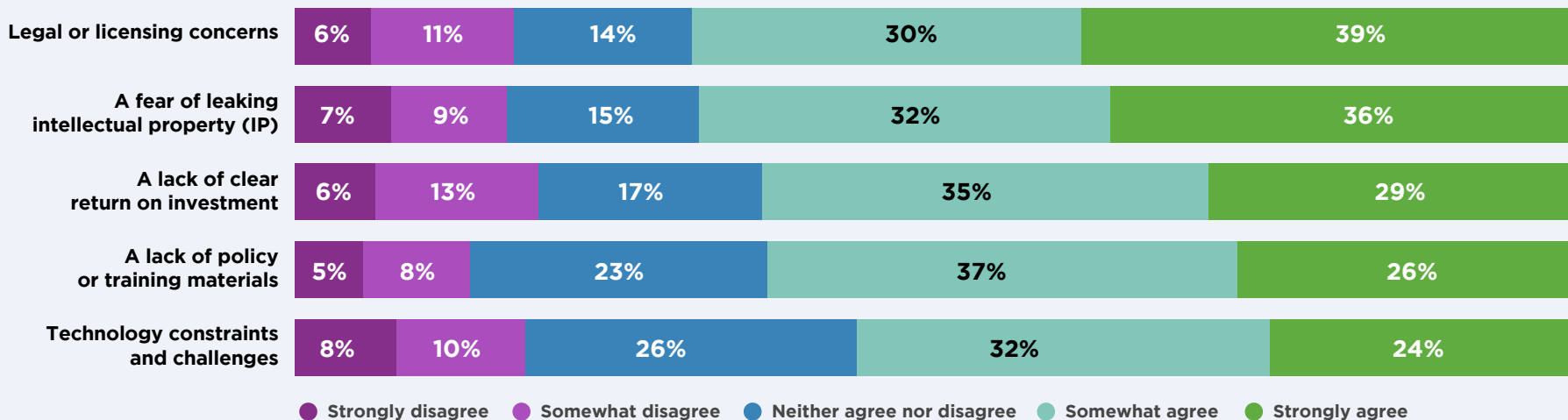


FIGURE 17

Steps to review code before it is released to external repositories

What are the steps that need to be reviewed before releasing the code? (check all that apply)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q22, SAMPLE SIZE = 157, VALID CASES = 157, TOTAL MENTIONS = 382

half of respondents indicate that each factor presented poses a challenge. “Legal or licensing concerns” tops the chart, with “A fear of leaking intellectual property” a close second.

One industry professional close to open source told us, “We’ve got a strong model around contribution for projects we open source, as this was the original focus of our governance activities/OSPO. We are working to make the process for contributing back to existing projects much easier; a key aspect of this is increasing automation in time-consuming & manually-intensive activities such as code/data loss prevention checks.”²²

A total of 63% of respondents also indicate that a “lack of policy or training materials” is problematic. Our discussions with subject matter experts reaffirm this and offer additional insight. According to one leader in a large bank, “Legal and clear policies matter, especially in regards to contribution. We are focused on ethics training in regard to code of conduct and no collusion to protect the firm and its employees—especially developers (working in open source).”²³ In another bank, there is “mandatory” training around open source, but even one of the organization’s open source advocates was unaware of this. This suggests that in some cases, policies do exist but are unknown. Representatives from another investment bank explained how they work to tackle this challenge by promoting their open source training offerings through multiple channels, including internal engineering sites, their human resources portal, engineering training sessions, newsletters, etc. They cannot, however, make it mandatory.

While “technology constraints and challenges” did not top the list, we know from our interviews that this poses a real challenge to increased contribution. A total of 74% of respondents indicate that their organizations have processes to release code externally, and **FIGURE 17** shows that these processes cover “quality checks & approvals,” “security

review,” and “legal and compliance sign-off.” (There has been minimal change in these statistics compared to 2021.) We also know that these processes are generally manual and time consuming and that more automation is needed. Financial institutions commonly require engineers to obtain pre-approval before making any external open source contributions, which can take weeks or even months. Some organizations have policies that prohibit open source contribution from work devices, although contribution may be allowed outside of the workplace provided the open source project uses a license that meets established license requirements.

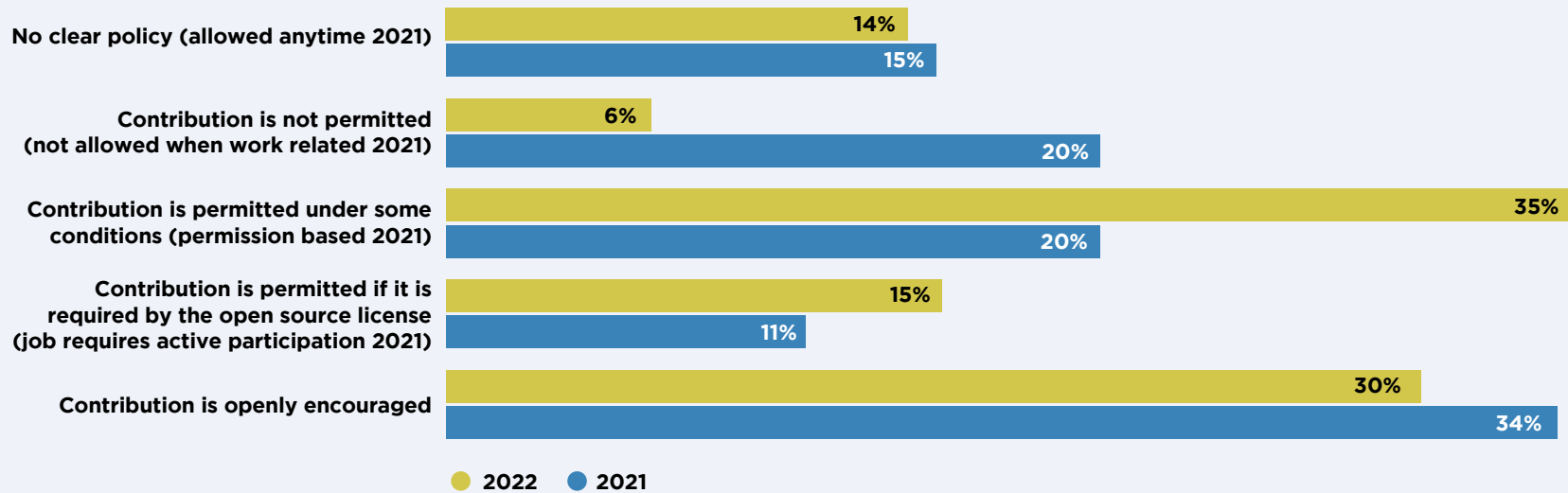
CONTRIBUTION IS BECOMING MORE ACCEPTABLE BUT IS STILL NOT OPENLY ENCOURAGED

As reported in the previous section, there has been significant growth in openly encouraging open source consumption in the last year. As **FIGURE 18** shows, there has also been a positive shift in policies related to open source contribution, notably a 75% increase (20% in 2021 to 35% in 2022) in contribution being permitted under some circumstances as well as a 70% decrease in the percentage of firms that do not permit contribution (6% in 2022 from 20% in 2021).

FIGURE 18

Organizational policy on contributing to open source projects in 2022 and 2021

What statement is closest to your current organization’s policy on contributing to open source projects? (select one)



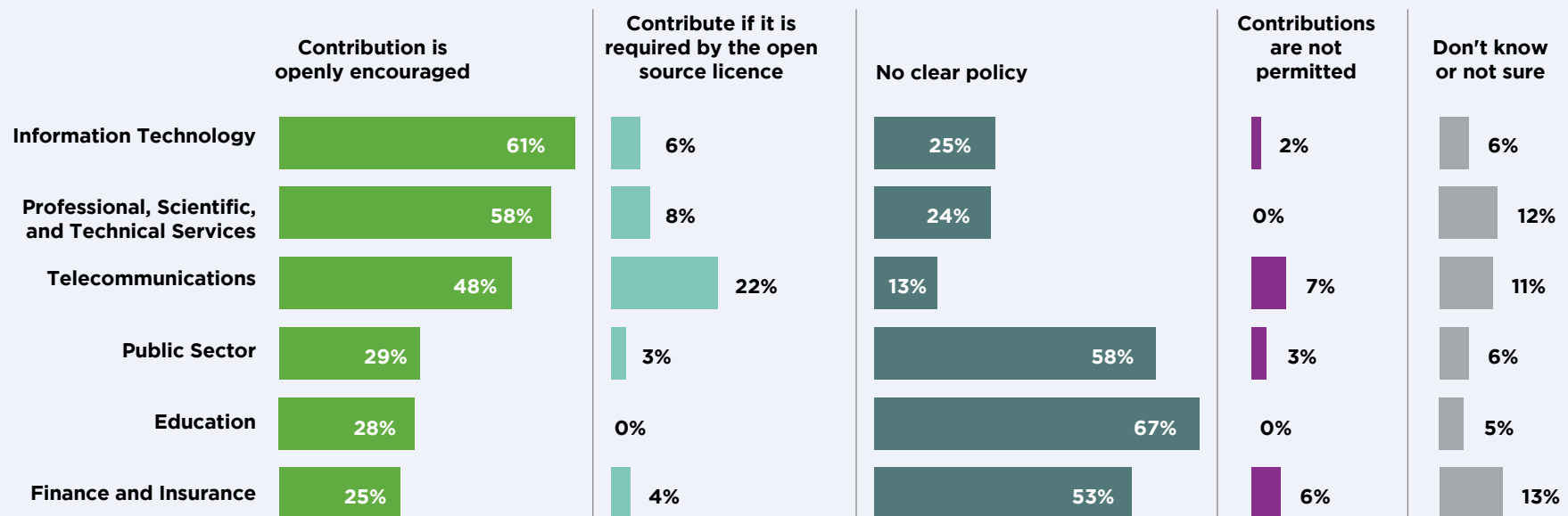
2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q20, SAMPLE SIZE = 203
 2021 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q35, SAMPLE SIZE = 98

We also compared financial services with other industries by looking at results from a recent survey that spanned multiple sectors. The numbers in that survey (**FIGURE 19**) show that financial services still lags behind other industries in openly encouraging contribution. (This is the case despite there being a slight difference in survey results, with 30% openly encouraging contribution in our survey compared to 25% in the cross-sector survey.)

This finding is consistent with our assertion that although financial services firms are increasingly understanding the

value of open source, establishing policies, and working on awareness, they are further behind in developing and implementing the requisite tools and processes that streamline open source contribution. As one individual close to open source at his organization told us, “We think it’s important to be able to contribute to upstream projects. If you can’t patch, you may have to fork internally and then keep merging upstream changes and rebuilding, so it’s inefficient. It’s also the right thing to do and is consistent with our values. We still have work to do to make our processes more scalable, but we see the value.”²⁴

FIGURE 19
Variations in contribution policy based on the sector



2022 WORLD OF OPEN SOURCE: EUROPE SPOTLIGHT SURVEY, Q8 X Q20, SAMPLE SIZE = 760

CONTRIBUTION IS INCREASING, DESPITE THE CHALLENGES

Encouragingly, and despite the challenges, **FIGURE 20** shows that organizations are making more time for open source contribution. A total of 38% of respondents told us that in the last year, their organization has allocated more time for them to contribute to open source.

This is a significant improvement and particularly interesting when compared with the responses seen in **FIGURE 21** below from the World Of Open Source: Europe Spotlight 2022 report, where we see a greater increase in time allotted for contribution within financial services than across sectors in Europe. This points to increased focus on open source within the financial services industry and sets the expectation that contribution will continue to increase across the industry.

FIGURE 20

The change in time that organizations allocate to open source contribution

Over the last year, the time and effort your organization has allocated for you to contribute to open source has: (select one)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q24, SAMPLE SIZE = 198

FIGURE 21

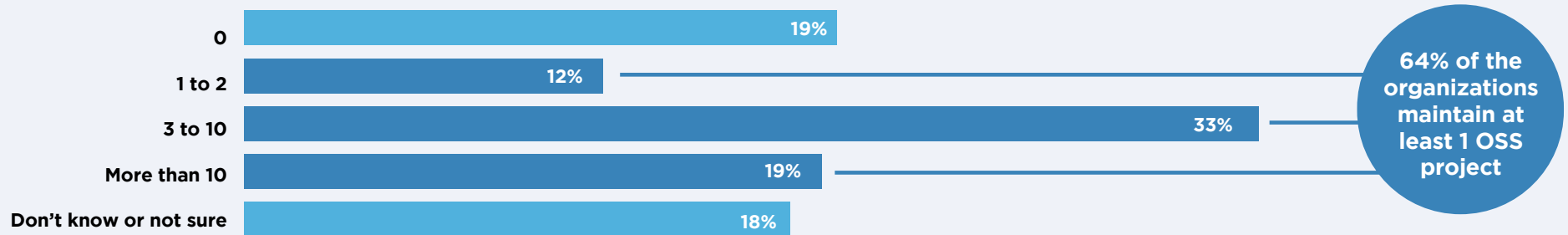
Perceived changes in contribution effort over the last year at the respondent's organization



2022 WORLD OF OPEN SOURCE: EUROPE SPOTLIGHT SURVEY, Q24, SAMPLE SIZE = 703

FIGURE 22 Number of open source projects maintained

How many open source projects does your company maintain? (select one)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q29, SAMPLE SIZE = 198

This year, we introduced a new survey question to learn more about organizational contribution, asking respondents how many open source projects their organizations maintained, with results shown in **FIGURE 22**. We see that most organizations (64%) maintain at least one open source project, with one third saying they maintain between three and 10 projects. While this may be low compared with other industries, it reflects the journey that the financial services industry is taking, with an increasing number of organizations moving from consumption only to consumption and contribution.

As stated in the beginning of this section, contribution can take many forms, which **FIGURE 23** reflects below.

Evaluating this response by company size, we see that smaller companies are making more contributions across all types measured. This may indicate that smaller companies

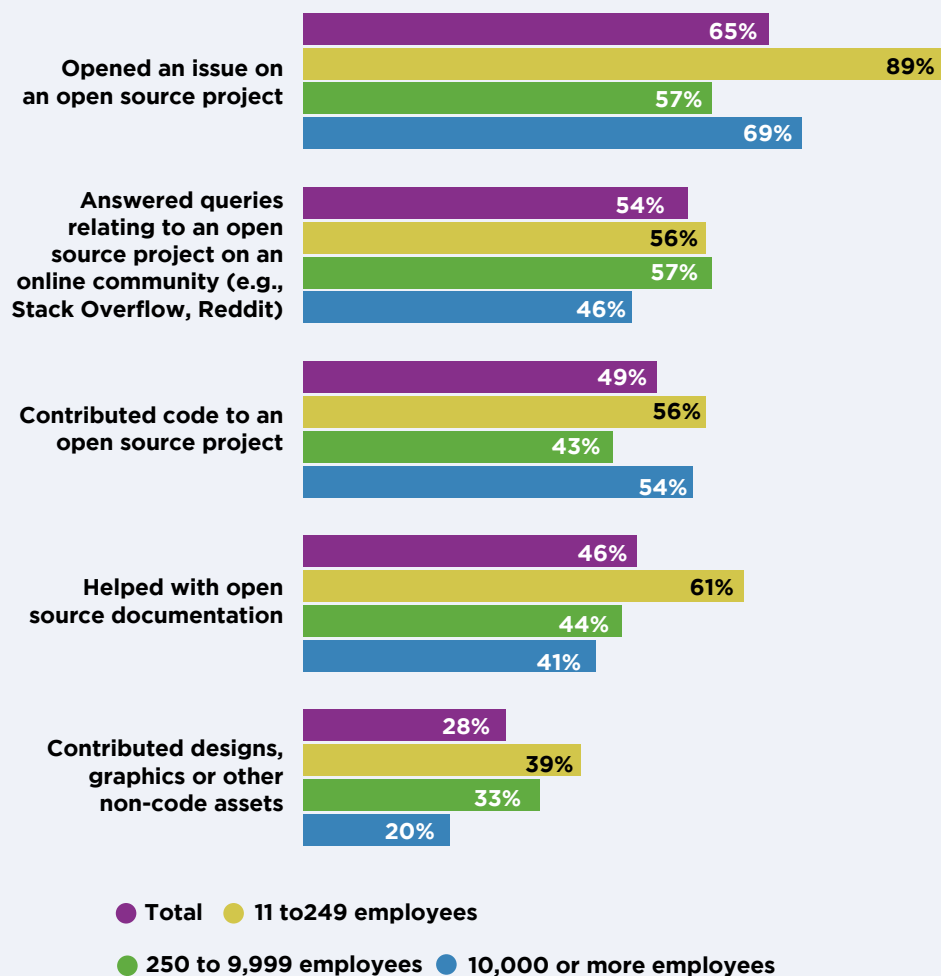
are more agile and able to implement the necessary policies, processes, and tools faster than larger companies. However, large enterprises (10,000 employees or more) are significantly involved in opening an issue and contributing code to an open source project.

In addition to how and how often respondents are contributing to open source, we explored the areas in which their organizations are making open source contributions. Unsurprisingly, the responses, as **FIGURE 24** shows, largely mirror the responses to the same question on open source consumption. One exception is that Linux Kernel is much higher up on the list for consumption (36% of respondents cited using it) than it is for contribution. Kernel development is a very specialized field (developed in C/C++), and we showed earlier that financial services organizations are primarily contributing to projects in Java, JavaScript, Go, and Python.

FIGURE 23

Types of open source contribution

On behalf of your organization, have you ever: (check all that apply)
segmented by: How many employees the organization has worldwide

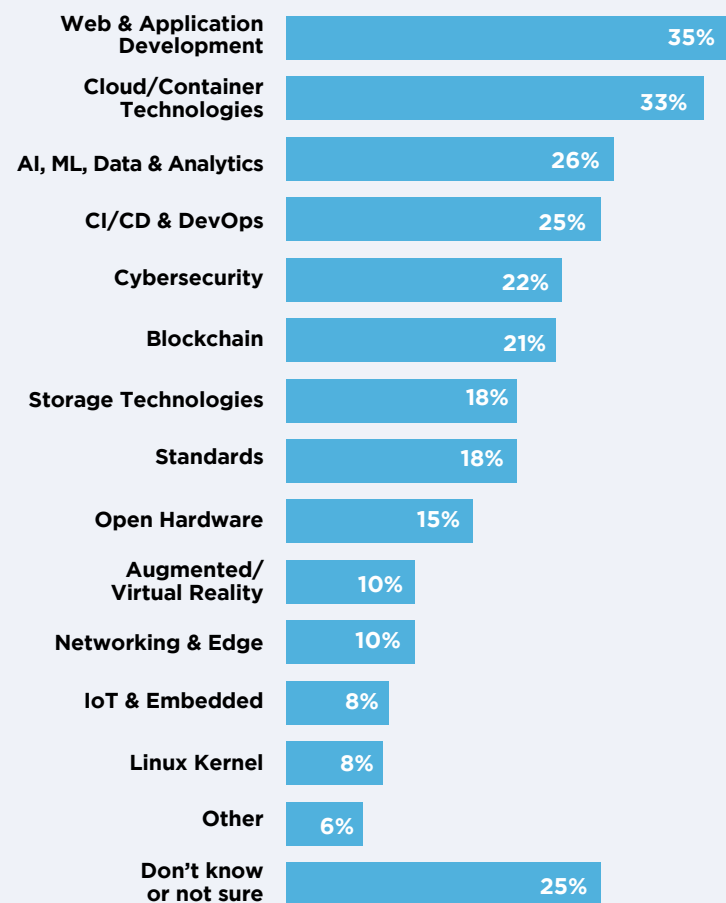


2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q25 X Q7, SAMPLE SIZE = 198, VALID CASES = 198, TOTAL MENTIONS = 400, NOTA EXCLUDED

FIGURE 24

Areas of open source contribution

In which of the following areas does your organization contribute to open source: (check all that apply)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q23, SAMPLE SIZE = 198, VALID CASES = 198, TOTAL MENTIONS = 552

INNER SOURCE LEADS OVER OPEN SOURCE CONTRIBUTION

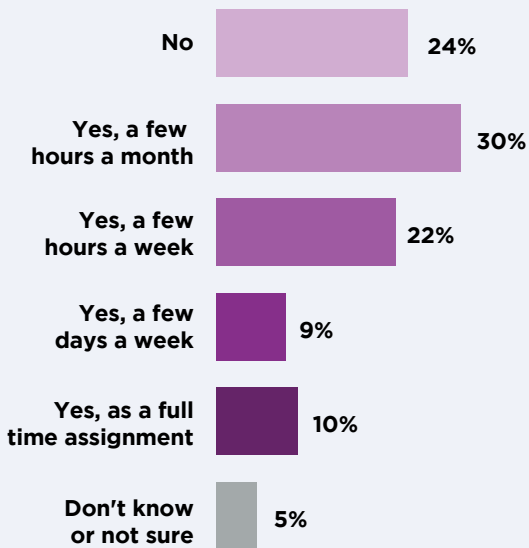
As mentioned in the beginning of the report, many organizations are focusing on inner source efforts. Especially for large organizations, inner source presents an opportunity to reap many of the widely touted open source benefits—innovation, time-to-market, reduced total cost of ownership—internally without the same level of scrutiny and process required to release code externally.

FIGURE 25 shows the response to our question regarding work time spent on contributions to projects both within the respondent's own organizations and external to their organizations.

We can see that 71% of individuals reported spending some time on inner source contributions compared with 51% who spent time on projects their companies have open sourced and 50% on third-party projects. It's also notable that in each case, there is a percentage of individuals for whom

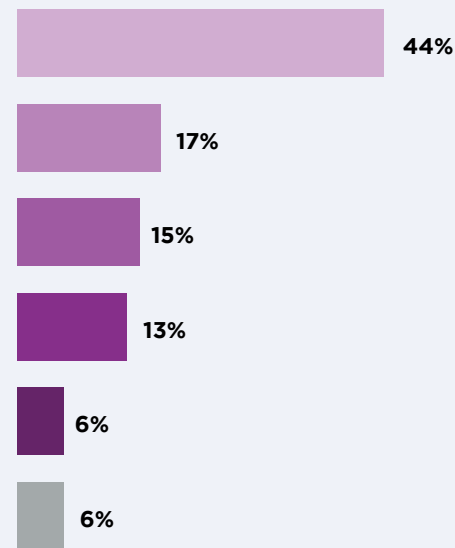
FIGURE 25
Work time spent on inner source and open source projects

Do you spend any time at work contributing to projects that are managed by other teams within your organization (i.e. inner source projects)? (select one)



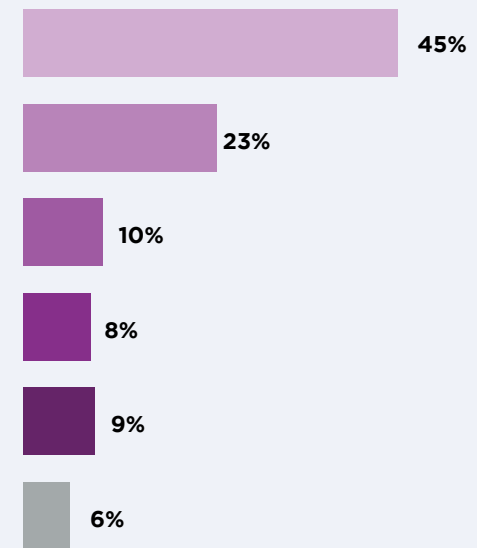
2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q30, SAMPLE SIZE = 198

Do you spend any time at work contributing to externally distributed open source projects that your employer founded, adopted or sponsors? (select one)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q31, SAMPLE SIZE = 198

Do you spend any time at work contributing to third-party open source projects (i.e. those where your employer has no commercial relationship)? (select one)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q32, SAMPLE SIZE = 198

contributing to projects managed by another team, or to open source projects themselves, is a full time assignment.

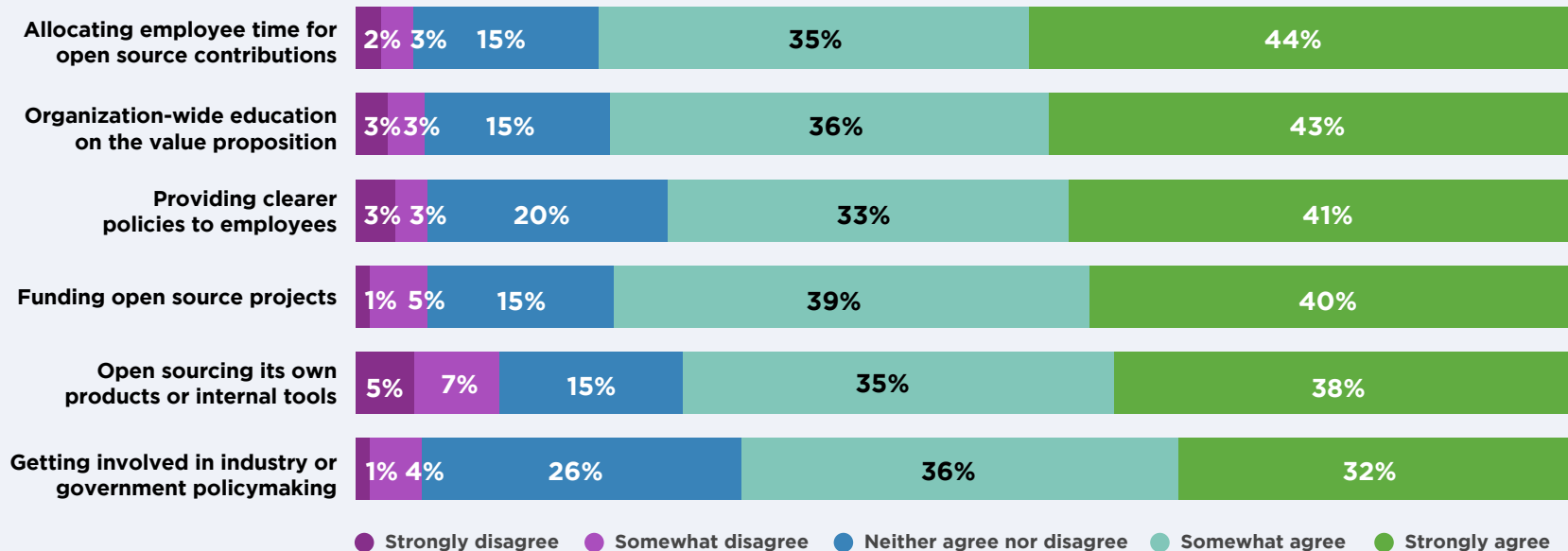
In our interviews, we learned of a variety of approaches to inner source. For example, in one large investment bank, they are beginning to encourage more inner source activities, but there is no central push for this. That bank's current focus is on internal collaboration around small components with minimal dependencies, as this makes the overall collaboration

and management of the code easier. In several other firms, there are dedicated inner source teams focused on making internal repositories more open and widely promoting code reuse across areas of the, often siloed, organizations.

FIGURE 26 shows that respondents identified several areas for their organizations to focus their efforts on to increase contribution, demonstrating that there is no shortage of improvements to make.

FIGURE 26
How organizations can increase their level of open source contribution

My organization's contribution to OSS would increase if it focused investment or effort on:



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q28, SAMPLE SIZE = 186-191, DKNS EXCLUDED

Leadership

In this section, we explore how different forms of leadership, from bottom up to top down, impact the perception and success of open source in an organization. We also look at several challenges that leaders need to address. We find that:

- There has been a slight (16%) increase in the prevalence of OSPOs within financial services organizations.
- Having an OSPO or visible leader has a significant positive impact on employees' perception of their organizations as leaders in open source.
- Comparing organizations with OSPOs to those without, those with OSPOs are just over twice as likely to openly encourage consumption and almost three times as likely to openly encourage contribution.
- While those in both business and technology roles influence open source in their organizations, technologists are viewed as slightly more influential.
- Open source leadership is nuanced and requires leaders of all levels of seniority from individual developers to executives to address such challenges as siloed workforces and cultural differences.

OSPOS AND SENIOR OPEN SOURCE LEADERSHIP ARE BECOMING MORE PREVALENT

One critical way for an organization to show commitment to open source and provide a visible form of leadership is to create an OSPO, ideally with one or more senior, visible leaders advocating for open source within their organization.

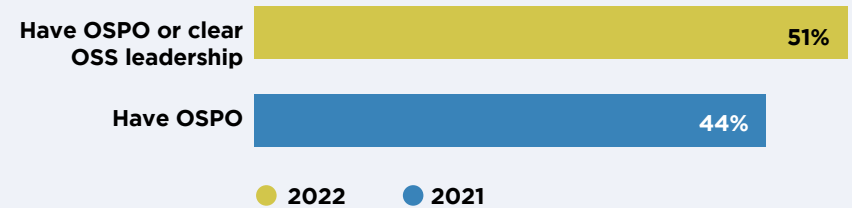
FIGURE 27 shows that the number of organizations with OSPOs or clear leadership in 2022 has grown by 16%, from 44% with an OSPO in 2021 to 51% with an OSPO in 2022.

Having an OSPO in place has a positive impact on employees' perceptions of open source in their organizations. **FIGURE 28** shows that 69% of respondents in organizations (those who

FIGURE 27

PRESENCE OF OSPOS OR REVIEW BOARDS

Do you have an Open Source Program Office (OSPO) or formal review board?



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q9, SAMPLE SIZE = 249
2021 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q11, SAMPLE SIZE = 135

strongly agree or somewhat agree) with an OSPO believe that their firm is a leader in open source within the financial services compared with 22%, where there is neither an OSPO nor visible OSS leadership.

Organizations with OSPOs also tend to have relatively senior open source leaders. **FIGURE 29** shows that collectively, 73% of organizations with an OSPO or visible OSS leadership are led by C-, managing director-, executive director-, or director-level staff.

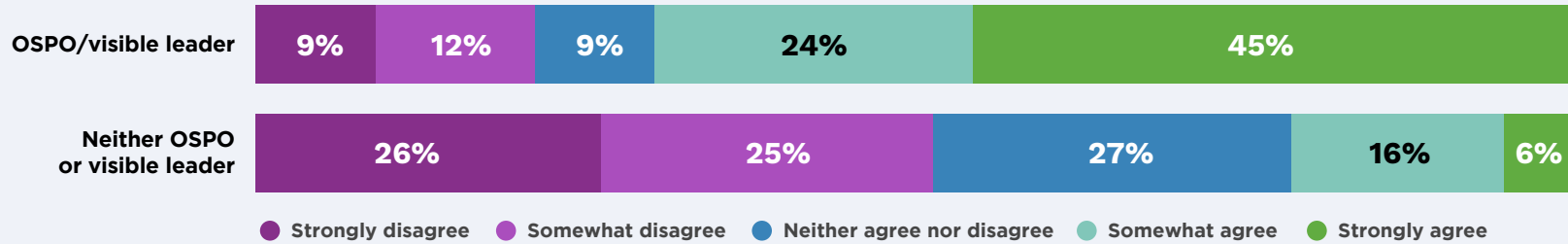
OSPOS INCREASE CONSUMPTION AND CONTRIBUTION

The most compelling findings related to having an OSPO are the significant positive influence they have on encouraging both open source consumption and contribution within an organization. **FIGURE 30** shows that organizations with a visible OS leader or OSPO (62%) are just over twice as likely to have a policy openly encouraging consumption than those without (29%).

FIGURE 28

View of employer as an open source leader depending on the presence of an OSPO

To what extent do you agree with the following statement: “My employer is a leader in open source” (select one) segmented by: OSPO/visible leader or neither

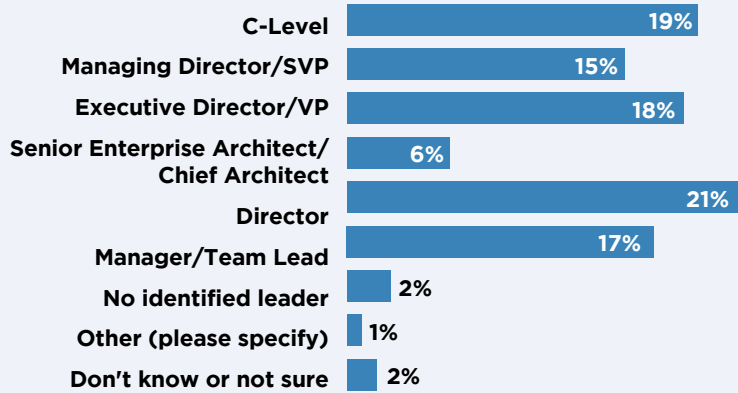


2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q8 X Q9, SAMPLE SIZE = 186-191, DKNS EXCLUDED

FIGURE 29

Seniority level of open source leadership when an OSPO exists

What level of seniority is your open source leadership (individual leader, primary advocate, or most senior member of OSPO)? (select one) for organizations with an OSPO/visible leader

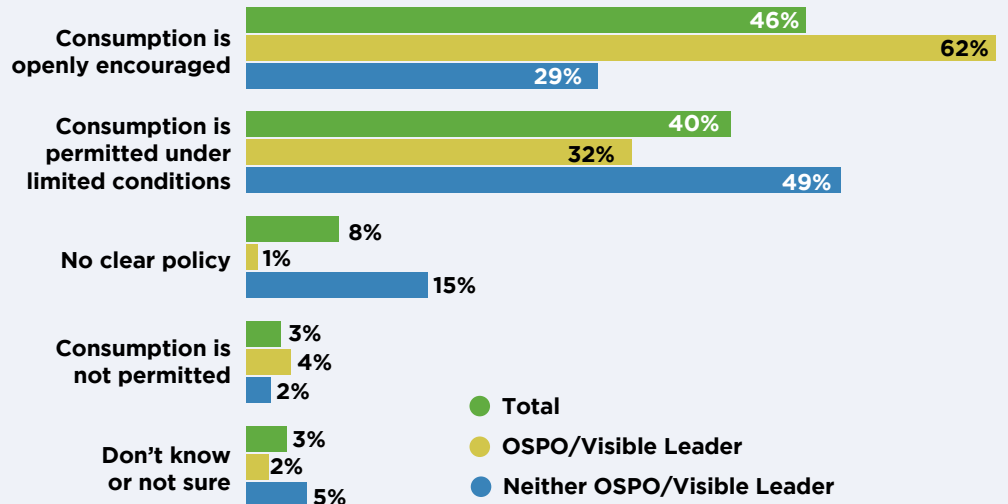


2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q10 X Q9 SAMPLE SIZE = 127

FIGURE 30

Organizational policy on consuming open source depending on the presence of an OSPO

What statement is closest to your current organization's policy on open source consumption? (select one) segmented by: OSPO/visible leader

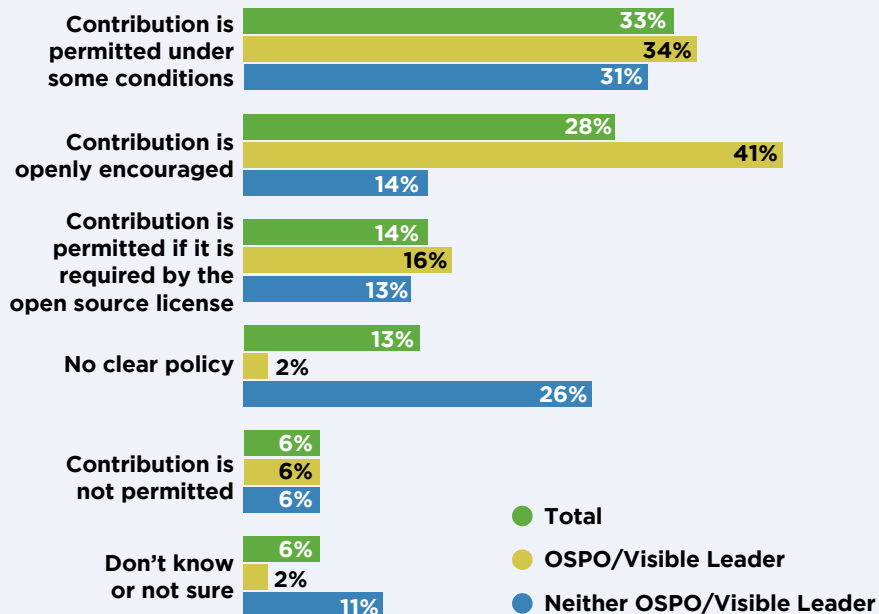


2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q12 X Q9, SAMPLE SIZE = 210

FIGURE 31

Organizational policy on contributing to open source projects depending on presence of an OSPO

What statement is closest to your current organization’s policy on contributing to open source projects? (select one) segmented by: OSPO/visible leader



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q20 X Q9, SAMPLE SIZE = 203

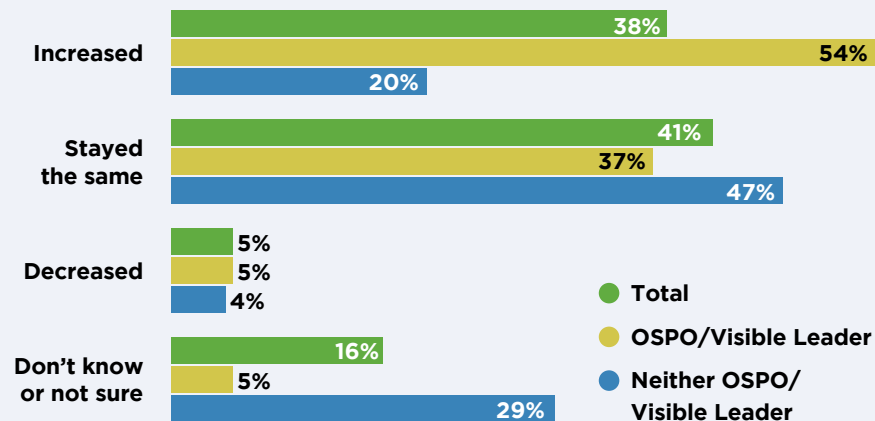
FIGURE 31 shows similar results for contribution, where the presence of an OSPO almost triples the number of organizations with policies that openly encourage contribution (41% compared with 14%). There is also a much higher awareness of there being policies in place.

This is unsurprising as organizations with OSPOs or visible open source leaders are more likely to consider open source as strategic for their firms and an important enabler. According to

FIGURE 32

Time that organizations allocate to employees for open source contribution depending on the presence of an OSPO

Over the last year, the time and effort your organization has allocated for you to contribute to open source has: (select one) segmented by: OSPO/visible leader



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q24 X Q9, SAMPLE SIZE = 198

Gil Yehuda, Head of Open Source at U.S. Bank, “Policies tend to be about things you can’t do, not about things you should do. They are designed to prevent bad things from happening, as opposed to enabling opportunity. We have an initiative to create the opportunity to view technology more strategically.”²⁵

Firms with a visible OS leader or OSPO are also much more likely to allocate time for their employees to make open source contributions. **FIGURE 32** shows that over half (54%) of respondents in organizations with an OSPO have been allocated more time for contribution in the last year compared with less than a quarter (20%) in organizations without OSPOs. Establishing an OSPO or creating a leadership role for open source not only signals a commitment to open source but also has a substantial positive impact on the firm’s open source contributions.

These results point to the importance of establishing a group responsible for advancing policies and the implementation of those policies within a firm. It's also important to understand that establishing an OSPO is just the beginning and that those groups need to be structured, supported, and funded in a way that can lead to success.

As described by one bank open source leader, "OSPOs tend to operate through influence and ambassadorship across the organization. We have representation from legal, risk management, enterprise architecture, security teams, asset management, executive level, and engineers who all participate. Each is involved in the decisions that directly impact their areas of work."²⁶

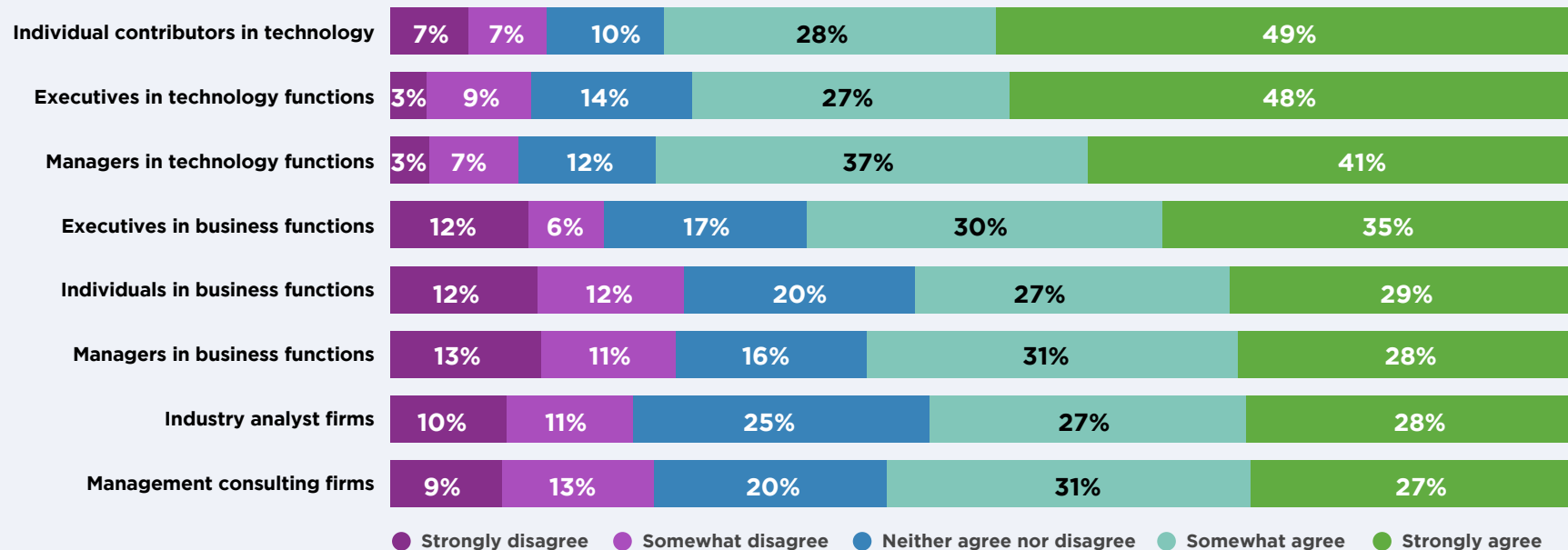
LEADERSHIP IS NUANCED

Finally, we look at who influences open source in respondents' organizations. **FIGURE 33** shows that individuals in technology roles have more influence than those in business roles, with individuals, managers, and executives having similar levels of influence. This points to financial services organizations benefiting from both bottom-up and top-down influences. While technologists are more influential, it is important to note that most respondents also recognized the influence of those in business functions. For open source to deliver to its potential, it's essential for an organization to have both business and technology leaders who recognize and promote its value.

CONTINUED ON PAGE 40

FIGURE 33
Individuals with influence over the direction of open source in their organizations

To what extent do you agree/disagree over the direction of OSS in your organization?



IN THEIR WORDS

Financial services leaders on leadership challenges

In our interviews, we heard numerous examples of the challenges that open source leaders face within financial services organizations. Below are a few examples that illustrate common challenges:

Cultural differences and silos are hard to navigate

One individual close to open source in their organization explained that one of their biggest challenges is cultural: dealing with inertia, silos, and inter-team collaboration. He noted that it can be very difficult to standardize and formalize policies across different groups and departments within the organization.

Open source stakeholders may have different priorities, which compete for resources

“Appetite may vary based on business function; it can depend a lot on the actual managing director. For example, in commercial investment banking, it is seen as massively important, where open source projects like Rosetta can revolutionize regulation by code. But there is not as much interest to invest in retail banking-focused projects.”²⁷

In one bank we spoke with, the stakeholders for initiatives related to open source consumption go all the way to the management board with significant top-down support coming from the CTO. However, in that same organization, the stakeholders focused on contribution work in another department and don’t benefit from the same level of senior support.

“One of the challenges in defining an open source policy and implementing corresponding practices stems from differing views on the level of risk that is acceptable. Getting to zero vulnerabilities is extremely difficult, so it’s important to factor in the potential impact of vulnerabilities when determining risk. It’s equally important to have senior management agree to a policy that can be achieved at this level.”²⁸

Bottom-up and top-down leadership both add value

Bottom-up and top-down support are important. According to one interviewee:

“Our CTO and VP are keen on promoting emerging tech utilizing a top-down approach but also with developer ambassadors. This creates better top-down alignment. This helps me and the OSPO make sure that the things we do are embedded into our core business. It’s clear that the OSPO’s job is to be aligned with the business.”²⁹

Another interviewee described the bottom-up approach. They said:

“When it comes to contribution, it is definitely a bottom-up push. We have engineers who really believe in contributing to open source and have pushed it.”³⁰

Opportunities

In the final section of the survey, we asked respondents to identify the top opportunities open source holds for financial services. In this section, we report that:

- There is overwhelming agreement that open source is valuable to the future of the industry.
- More collaboration could improve open source policies, processes, and tooling.
- The top areas in which the industry can benefit from open source include digital identity, common workflows, and innovation.
- “AI, ML, Data and Analytics” was the most valuable technology for the future of financial services.

We’ve shown that efforts around both consumption and contribution have grown in the last year, and all indicators

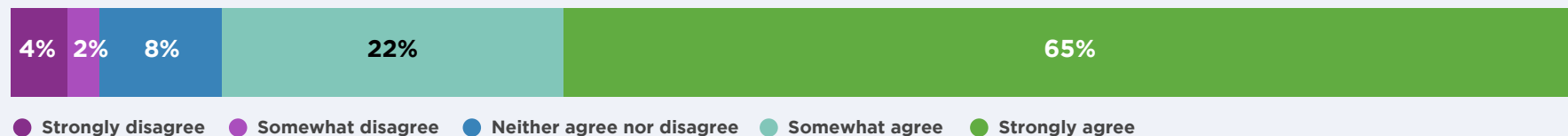
point to this trend continuing. As organizations continue to understand the value of open source, there is an opportunity to reframe the strategic importance of technology.

There is also an opportunity to improve existing policies and processes. As one senior leader noted, “If there was tooling that allowed us to plug into the same security scanning workflows we use for external libraries, enabling the security controls to apply to any code going to open source before it goes public, that would go a long way in addressing concerns that firms have about contributions.”³² Firms also need to understand that policies, especially those which may have been written many years ago, need to undergo continuous updates. As technology evolves, organizations find themselves with new audiences, more automation, and an ability to see the present through a lens that perhaps didn’t exist at the time of an open source policy’s initial creation. One leader close to open source in a bank explained that they

FIGURE 34

Open source is valuable to the future of the financial services industry

To what extent do you agree that open source is valuable to the future of the financial services industry? (select one)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q35, SAMPLE SIZE = 189, DKNS EXCLUDED

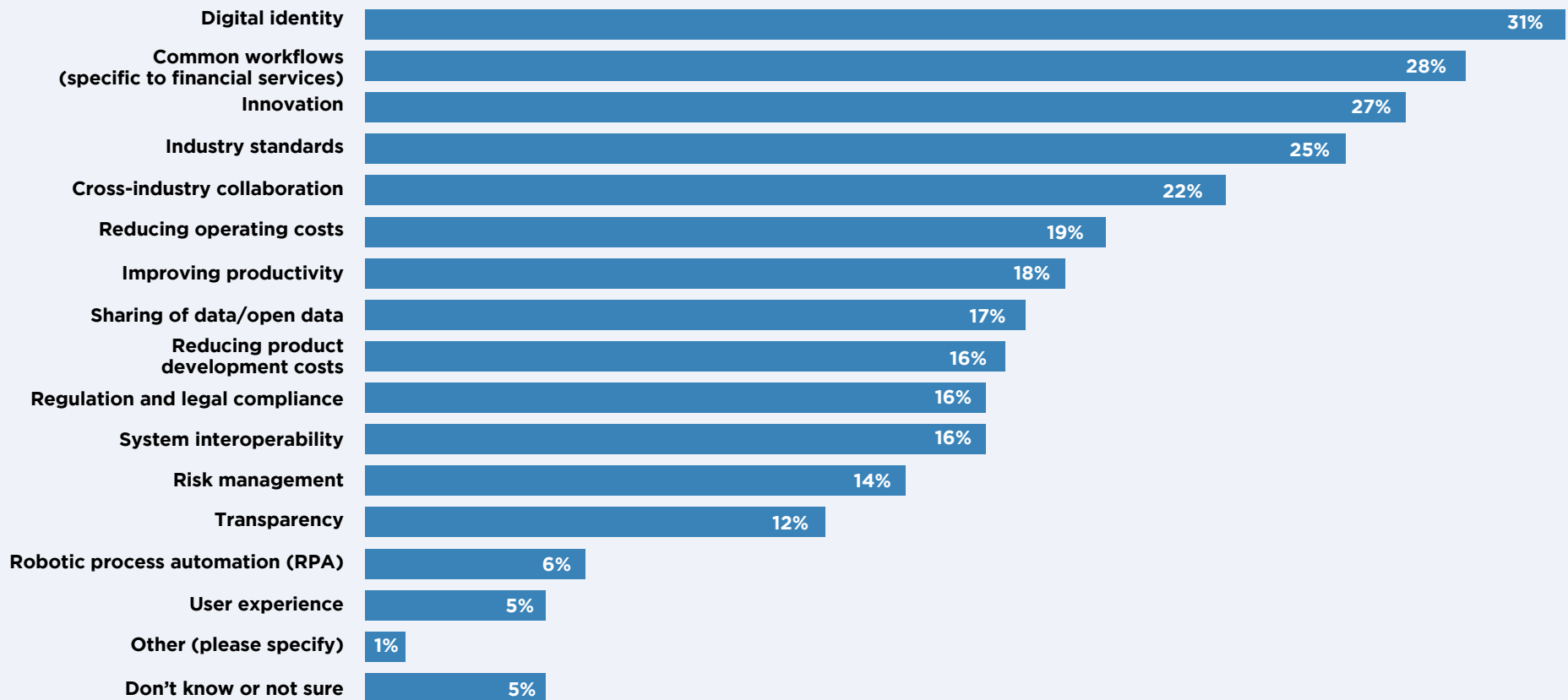
focus on implementing processes that can handle changes in tools since tools are likely to change, but processes tend to stick around for a long time. There is a real opportunity here for much more substantial industry collaboration to address policy, process, and tooling challenges.

In terms of where open source can and should be applied within the financial services industry, **FIGURE 35** below shows that opportunities abound, with no strong consensus on a single aspect of the industry. With an industry this large and complex, we would expect a wide range of opportunities.

FIGURE 35

Many aspects of the financial services industry would benefit from open source engagement

Which aspects of financial services would most benefit from open source? (select up to three)



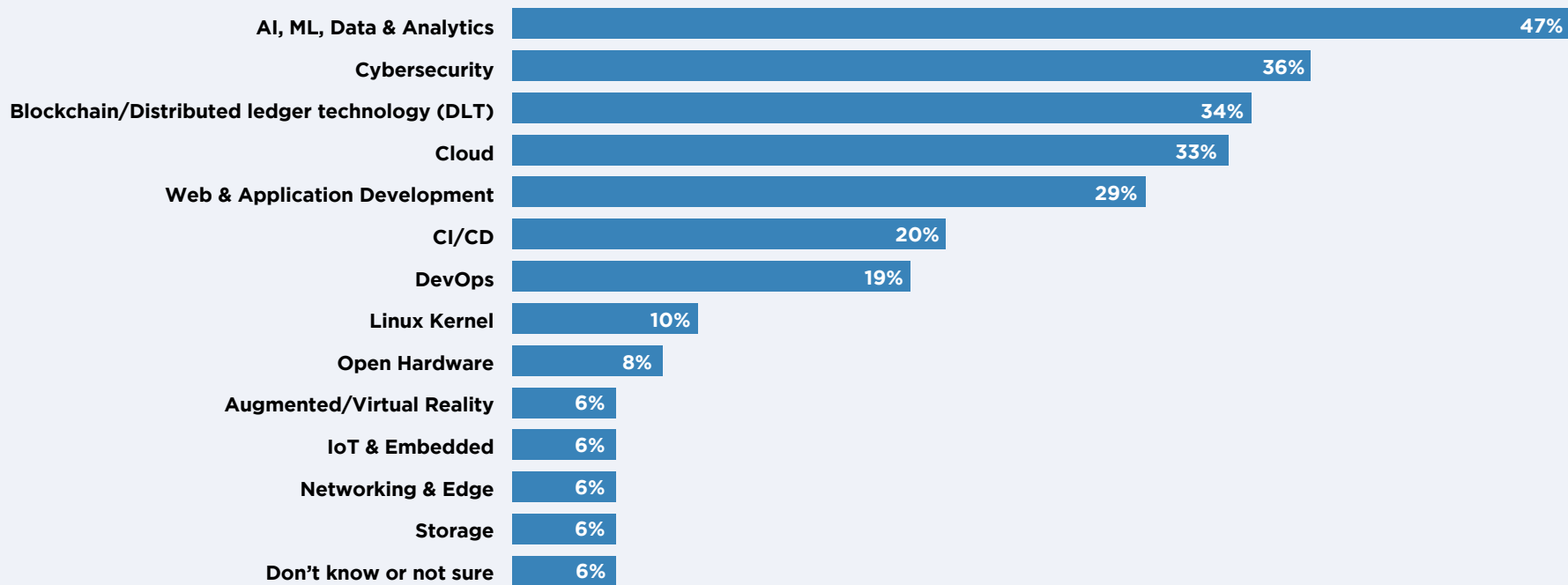
Regarding which technologies respondents identified as valuable to the future of financial services, **FIGURE 36** shows that “AI, ML, and Data & Analytics” ranked top, which increased from its third-place ranking in 2021. Cybersecurity was the second ranked technology in this year’s survey, which speaks to its importance as an area requiring both attention and investment.

One individual highlighted a focus area that has the potential to unlock progress across the board: “If there is an opportunity to engage with regulators to agree what best practices look like for open source in financial services, this could help unlock benefits for the entire industry.”³³

FIGURE 36

Areas of open source identified as valuable to the future if financial services

Which open source technologies do you feel are the most valuable to the future of financial services? (select up to three)



2022 FINOS STATE OF OSS IN FINANCIAL SERVICES SURVEY, Q37, SAMPLE SIZE = 196, VALID CASES = 196, TOTAL MENTIONS = 519

Conclusions and actionable insights

Increased focus on open source will improve security

The financial services industry is undoubtedly increasing its open source engagement across a broad range of institutions, both large and small, but still lags behind other industries. The positive trend is encouraging as borne out by the data in this report and recent industry activities such as ISDA's (well-established industry standards body focused on derivatives) announcement to [open source its Common Data Model \(CDM\)](#). As described in this report, the industry is a massive consumer of open source, and with open source security receiving a high degree of attention and scrutiny across industries, it is the right time for financial services organizations to increase their budget for, and focus on, establishing policies and implementing processes for both consumption and contribution. One industry professional explained that financial services tends to be quite restricted in what it allows and that this is inherent to the nature of the industry. It's only a matter of time before a pressing problem arises, and organizations find themselves unable to contribute a much-needed fix.

Here are a few actions the industry can take:

- Engage in cross industry collaboration through partnerships with foundations such as [OpenSSF](#) to increase the understanding of open source.
- Implore more regulators (some are already making progress) to focus on supporting the industry's open source collaboration, and establish groups within their organizations to focus solely on this.
- Identify the open source libraries most commonly used within the industry, and focus on enabling contributions to those libraries.

“Understanding open source usage can really help drive the conversation on contribution.”³⁴

Focus on the value proposition and moral imperative of open source

Statistics shared in the report, including the increase in GitHub commits and a better number of financial institutions open sourcing their own code, point to growth in the open source community within financial services. We have additional evidence to support a growing community, such as double the number of attendees joining a conference dedicated to open source in financial services, a substantial increase in FINOS membership, and a very large increase year-on-year in downloads of financial services specific open source projects hosted by FINOS. Another observation that struck the authors this year was a much stronger sense of moral obligation to contribute to open source than in previous years. Such statements as, “If you are leveraging a significant amount of open source, there's definitely a responsibility there to contribute back. It's not just for other people to do in their spare time.”³⁵ were far more prevalent. However, that's not to say that there still isn't more work to do.

Here are a few suggestions to continue building the financial services open source community:

- Financial organizations with OSPOs (or looking to form OSPOs) should commit one or more resources to join collaborative efforts (including tooling and workflows) aimed at solving challenges the highly regulated community faces around making contributions.

- Organizations newer to open source should identify one or more individuals within their organizations to be open source advocates and allot time for them to participate in open source community activities.
- Individuals interested in open source or collaboration more generally should dedicate some time to finding an open source community working on a topic of interest to them.

While many organizations are making great strides, far more need to follow their lead

It is very encouraging that financial services organizations are more openly supporting both consumption and contribution, allotting more time for individuals in their organizations to participate in open source activities and recognizing the value of open source for talent attraction and retention. The increasing number of OSPOs and the positive sentiment toward open source within organizations is a good foundation to build upon. There are still challenges that must be addressed and a long path to reaching the open source maturity of other industries, but there is an increasing number of organizations taking the right steps to solve these.

Based on the survey findings, we suggest that organizations:

- Establish an OSPO with senior and visible leadership, and produce clear policies on consumption and contribution.
- Widely and consistently promote awareness of open source policies. Consider mandating training on the policies until open source is embedded within the culture of the organization.
- Provide education on best practices in open source, license management, community building, etc. (Individuals, if your organization isn't offering this education, ask for it.)
- Establish internal, cross-departmental forums for individuals to share their open source experiences and successes, helping to break down silos and retain talent.

Clearly, the financial services industry has plenty of work ahead for it to realize the full value of open source. Collaboration among industry competitors to create shared benefits takes time, dedicated resources, a leadership vision, and a cultural environment primed for open source innovation. While a strong foundation exists, open source in the financial services is in its earliest days. This truth is perhaps best captured in the words of one industry leader, who states, "How we in the financial services industry work with our peers in open source project communities is a muscle that we still need time to develop."³⁶

Endnotes

- 1 The 2021 The State of Open Source in Financial Services Report double-counted some repositories due to data processing errors, hence the values reflected in this report (for 2021) are lower than those in the previous report.
- 2 Interview with Gil Yehuda, Head of Open Source at U.S. Bank. May 27, 2022
- 3 Interview with OSPO leader at a prominent North America-based asset manager. June 2, 2022
- 4 Interview with Technical Architect at multinational investment bank and financial services firm, Sept 8, 2022
- 5 Interview with Elspeth Minty, Managing Director, RBC Capital Markets, August 29, 2022
- 6 Interview with distinguished engineer, global bank, October 19, 2022
- 7 Interview with Head of Open Source at a US financial services institution, Sept 9, 2022
- 8 Census II of Free and Open Source Software — Application Libraries, [linuxfoundation.org/wp-content/uploads/LFResearch_Harvard_Census_II.pdf](https://www.linuxfoundation.org/wp-content/uploads/LFResearch_Harvard_Census_II.pdf)
- 9 Interview with OSPO leader at a prominent North America-based asset manager, June 2, 2022
- 10 Interview with OSPO leader at a prominent North America-based asset manager, June 2, 2022
- 11 World of Open Source: Europe Spotlight 2022, www.linuxfoundation.org/research/world-of-open-source-europe-spotlight
- 12 Interview with Jonathan Haggarty, Head of Bank APIs Technology, Natwest. August 17, 2022.
- 13 www.sonatype.com/state-of-the-software-supply-chain/software-supply-chain-maturity
- 14 Interview with Jonathan Haggarty, Head of Bank APIs Technology, NatWest. August 17, 2022.
- 15 Interview with Distinguished Engineer at a global bank, October 19, 2022
- 16 Interview with Distinguished Engineer at a global bank, October 19, 2022
- 17 Interview with OSPO leader from a prominent North America-based asset manager, June 2, 2022
- 18 Interview with Elspeth Minty, Managing Director, RBC Capital Markets, August 29, 2022
- 19 Interview with Elspeth Minty, Managing Director, RBC Capital Markets, August 29, 2022
- 20 Interview with Technical Architect at multinational investment bank and financial services firm, Sept 8, 2022
- 21 Interview with Head of Open Source at a US financial services institution, Sept 9, 2022
- 22 Interview with open source lead at global investment bank, September 29, 2022.
- 23 Interview with Technical Architect at multinational investment bank and financial services firm, Sept 8, 2022
- 24 Interview with distinguished engineer, global bank, October 19, 2022.
- 25 Interview with Gil Yehuda, Head of Open Source at U.S. Bank, May 27, 2022.
- 26 Interview with Gil Yehuda, Head of Open Source at U.S. Bank, May 27, 2022.
- 27 Interview with Technical Architect at multinational investment bank and financial services firm, Sept 8, 2022
- 28 Interview with Mark Hoare, Deutsche Bank, September 29, 2022.
- 29 Interview with Head of Open Source at a US financial services institution, Sept 9, 2022
- 30 Interview with Distinguished Engineer, global bank, October 19, 2022
- 31 Interview with Distinguished Engineer, global bank, October 19, 2022
- 32 Interview with Elspeth Minty, Managing Director, RBC Capital Markets, August 29, 2022
- 33 Interview with Sally Ellard, Deutsche Bank, September 29, 2022.
- 34 Interview with Mark Hoare, Deutsche Bank, September 29, 2022.
- 35 Interview with Elspeth Minty, Managing Director, RBC Capital Markets, August 29, 2022
- 36 Interview with OSPO leader from a prominent North America-based asset manager, June 2, 2022

Methodology

This research report draws on survey data, industry data, and insights culminating from a series of qualitative interviews. Senior IT leaders fluent in open source technologies, communities, and challenges were invited to share their insights.

In-depth interviews

Interviews were recorded so that transcripts could be produced. Such transcripts were strictly controlled and used only for purposes of this report. If a recording was not permitted, then detailed notes were taken. Questions were also shared for completion via email. Unless quotes were given explicit approval by the named individuals and/or their organizations, sources were anonymized.

About the survey

From July 12 to September 21, 2022, FINOS and its research partners fielded a worldwide survey of qualified individuals within (or providing services to) the financial services industry on various questions related to organizational open source consumption, contribution, opportunities, and challenges.

The quantitative survey was designed to engage key stakeholders at the intersection of open source and financial institutions, including developers, IT leaders, executive management, security, legal, procurement, and human resources. This was combined with distillation and benchmarking of previous work conducted

by the Linux Foundation and FINOS. The survey was distributed and promoted across research partner social media channels, websites, newsletters, and via direct email campaigns. The survey sample also included qualified responses from a third-party panel provider.

The data from the 2021 study and this 2022 survey are [openly available](#) on data.world. Like last year, this 2022 survey primarily focused on both end-user organizations and fintech vendors. End-user organizations are primarily consumers of IT products and services, whereas fintech vendors are primarily producers of IT products and services. We made comparisons between 2021 and 2022 questions where possible.

Percentage values in charts may not add up to 100% due to rounding.

Screening criteria

The qualified sample size analyzed for the 2022 survey was 249. This sample size reflects those respondents who passed various screening and filtering criteria, including the following:

- A respondent had to self-identify as a real person.
- A respondent had to be employed full or part time.
- A respondent had to be employed by the financial services industry or by a company that develops financial services focused technology (i.e., a fintech).

- A respondent had to be somewhat familiar, very familiar, or extremely familiar with their organization's approach to open source.
- A respondent had to answer the first content question after the screening and demographic questions.

The margin of error for this sample size (N = 249) is +/- 5.2% with 90% confidence.

Year-over-year comparisons

Comparisons were made between data collected in 2021 and 2022, question and response design permitting. Respondents had to answer nearly all questions in the survey, so there are situations when a respondent is unable to answer a question because it is outside the scope of their role or experience. For this reason, a "Don't know or not sure" (DKNS) response was presented to the respondent. The share of DKNS responses in a question influences the percentage values of the remaining responses. Generally, we present the percentage of respondents who answer DKNS as a valid response to each question.

One exception is when we are performing year-over-year comparisons. Differences in the percentage of DKNS responses between questions year over year will skew the comparative results. Therefore, when performing year-over-year comparisons, we exclude DKNS responses and recalculate percentages so that we have a normalized basis for comparing the remaining percentage values.

Resources

Reports

- [A Guide to Enterprise Open Source](#)
- [World of Open Source: Europe Spotlight 2022](#)
- [2021 State of Open Source in Financial Services Report](#)
- [A Deep Dive into Open Source Program Offices: Structure, Roles, Responsibilities, and Challenges](#)
- [A Guide to Open Source Software for Procurement Professionals](#)

Guides & Training

- [A Beginner's Guide to Open Source Software Development](#) (Free Training)
- [Using Open Source Code](#)
- [Releasing Internal Code into a New Open Source Project](#)
- [Marketing Open Source Code](#)
- [Tools for Managing Open Source Programs](#)
- [How to Create an Open Source Program Office](#)
- [Open Source Program Office 101](#) (Free Training)
- [Fostering An Open Environment For Developers In A Regulated Industry](#) (Webinar)

Projects

- [FINOS Open Source Readiness Special interest Group](#)
- [FINOS Inner Source Special Interest Group](#)
- [Open Source Project Catalogs](#) ([FINOS](#), [Linux Foundation](#), [Apache Foundation](#), [Eclipse Foundation](#))

Acknowledgments

This report and the research behind it would not have been possible without the contributions of many individuals. Beginning with the research team partners, the authors wish to thank the entire FINOS and Linux Foundation teams, including Gabriele Columbro, Alena Davis, Michael Dolan, Jane Gavronsky, Aaron Griswold, Lawrence Hecht, Anna Hermansen, Noah Lehman, Win Morgan, Niamh Parker, Jason Perlow, Julia Ritter, Melissa Schmidt, Alexandra Stratigos, and Chip Stuart; Scott Logic team members Paul Dykes and Claire Cocks; and Philip Holleran from GitHub. Together, this group facilitated various aspects of the research, including survey design, survey distribution, data analysis, and dataset contributions, and supported interview outreach.

We thank our partners from GitHub, Intel, Mend, Scott Logic, SUSE, Symphony, Tradeweb, and Wipro for helping to distribute the survey and all respondents who took the time to complete the survey. We are especially grateful to our interviewees, whose rich insights feature prominently throughout this report.

Finally, thanks to all who continue to contribute to open source in the financial services industry.

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This report has been updated since its original release on 12.15.22. This second version, released on 01.03.23, corrects errors found in the original text and graphics.



FINOS (The Fintech Open Source Foundation) is a nonprofit whose mission is to foster the adoption of open source, open standards, and collaborative software development practices in financial services. It is a regulatory compliant platform at the center of open source, enabling the financial services industry to develop new technology projects and standards that have a lasting impact on business operations. FINOS counts over 60 major financial institutions, fintechs, and technology consultancies as part of its membership. FINOS is also part of the Linux Foundation, the largest shared technology organization in the world.

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Founded in 2021, [Linux Foundation Research](#) explores the growing scale of open source collaboration, providing insight into emerging technology trends, best practices, and the global impact of open source projects. Through leveraging project databases and networks, and a commitment to best practices in quantitative and qualitative methodologies, Linux Foundation Research is creating the go-to library for open source insights for the benefit of organizations the world over.

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To reference this work, please cite as follows: Hilary Carter, Cara Delia, Tosha Ellison, Colin Eberhardt, Stephen Hendrick, Philip Holleran, "The 2022 State of Open Source in Financial Services," foreword by Gabriele Columbro, The Linux Foundation, December 2022.