THE LINUX FOUNDATION | Research

The State of Open Standards

Standardization and Patents in Organizations

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The State of Open Standards

73% of respondents say they **use standards as a selling point.**

77% of respondents agree that standardization helps their **markets mature and grow.**

76% of respondents agree that standardization **promotes competition and innovation.**

84% of respondents **aren't threatened** by **royalty-free standards.**

78% of respondents say **royalty-free standards drive high value.**

75% of respondents consider it extremely or very important that **specifications are widely reviewed.**

77% of respondents do not consider **monetizing standard essential patents** as a great return on investment.

1.6 times more respondents view **adopting open models** rather than filing patents as an **indicator of innovation.**

Adopting a defensive patent strategy is 3.8 times more common than an offensive one.

66% of organizations primarily participate in standard development organizations with **royalty-free patent policies.**

The #1 reason for participating in standards development is to **improve the interoperability** of systems or services.

Only 19% of respondents cited **fear of leaking intellectual property** as an obstacle to participating in standards development.

Contents

Foreword

Open standards are the bedrock upon which the internet was built. They are the invisible protocols and agreements that allow devices, services, and applications to communicate and work together seamlessly. From the networking protocols that shuttle data across continents in the blink of an eye, to the standards underpinning the ubiquitous Wi-Fi that connects us without a physical tether, to the cloud native computing standards that catalyzed development of a vibrant ecosystem around containerized applications - open standards are the unsung heroes of our connected world.

We have all witnessed firsthand the transformative power of open standards in fostering innovation, ensuring interoperability, and driving the growth of the digital economy. The very fabric of our digital life is woven with the threads of these standards, and as we stand on the cusp of a new era where everything digital runs on silicon, their importance in creating an accessible and sustainable digital world simply cannot be understated.

These open standards are more than just the technical underpinnings of our digital infrastructure; they are the value propositions that businesses leverage for competitive advantage. They instrument safety, enable interoperability, reduce costs through shared technology investments, and accelerate innovation by providing a common foundation upon which new ideas can be built. Companies now invest in research and development not just for their own growth but to contribute to a sustainable ecosystem of success. This spirit of cooperation extends across industries, academia, and the public sector. Governments worldwide also recognize the importance of fostering such innovation and openness, actively crafting policies to accelerate the transition to a digital economy.

As we look toward our Generative AI-enabled future, the importance of open standards throughout the entire computing stack will only grow. Convergence across the realms of artificial intelligence, edge computing, and the secure use of public and private datasets are creating a complex tapestry of interconnected devices and systems. Open standards will be the common language that ensures these technologies work together harmoniously, unlocking their full potential and enabling fair access to anyone with a material interest in them. They are embodiments of a philosophy, a commitment to a world where technology serves as a bridge rather than a barrier. As we continue to push the boundaries of what is possible with silicon, we must champion the cause of open standards, for they are the foundation upon which a truly connected and inclusive digital future will be built.

This report, “The 2024 State of Open Standards” from Linux Foundation Research comes at a time of astounding developments in technology and shines a beacon on the value that open standards bring to a domain, to a world that is so massively interconnected. Takeaways speak to the academics and thought leaders delving for the next breakthroughs, the architects and technologists scaling those breakthroughs for widespread implementation, the businesses reliant on these advances, and the policy makers who bring guardrails to steer innovation for global good. Thank you to the Linux Foundation for being the ongoing patron of this work, I hope all readers will find value in this report.

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Introduction

Technical standards define guidelines and specifications across products, services, or systems to ensure consistency, compatibility, and quality. They are fundamental in facilitating trade, ensuring product safety, and enabling interoperability between different technologies and systems. With such an interconnection of objectives, requirements and stakeholders, approaches to create technical standards tend to vary along a continuum of characteristics[1]. The Linux Foundation supports hundreds of projects that work to achieve standardization across various levels, from agreement within a single project's ecosystem to globally-adopted ISO Standards.

Central to the success of any standard is how easily it can be adopted, which depends in large part on the constraints or capacity of the implementing organization: for example, what will it cost, how long will it take, and what is the return on investment. However, there are other factors, as this report and its predecessor suggest, that improve the implementability of a standard. In particular, standards that have clear, easy-to-understand IP policies - including patent licensing terms - are more valuable to organizations. This is particularly salient for industries like telecommunications and computing, where there are a large number of patented technologies that may read on industry standards and specifications.

Patents protect novel inventions, granting their holders exclusive rights to use and commercialize these innovations for a defined period. Meanwhile, standards aim to establish a degree of uniformity, interoperability, safety, and efficiency within systems. Thus, there can be tension between the need to drive broad adoption of a standard and the need to protect a commercially valuable patented invention. Standard-setting organizations balance these interests by developing Intellectual Property (IP) policies such as contribution, review and exclusion procedures, licensing and notification requirements, and other policies for members and implementers. In this way, patented inventions that are essential to a standard are made available to market participants, fostering a competitive and innovative market environment. Nevertheless, the role of patents in software and information and communication technology standards has been a subject of intense debate, especially concerning their impact on innovation and market dynamics.

As noted in the Futures of Innovation and IP Regulation in 2040 report[2], innovation is changing along several dimensions and is thus challenging existing IP regimes in several critical ways, along social, economic, political, and of course technical lines. The 2040 report outlines several potential scenarios that could arise based on these changing dimensions, and emphasizes the effect open, multi-stakeholder innovation can have on IP frameworks. While each innovation scenario offers different implications for society in the future, standardization activities invite us to specify what kind of future we want to build[3].

Interestingly, our research also challenges the traditional view of patents in ICT as a primary indicator of innovation, and as valuable assets for return on investment. Instead, it suggests that many organizations file patents predominantly as a defensive strategy, to protect themselves in a litigious environment. Relatedly, data from a National Science Board report show that global Patent Cooperation Treaty application activity has declined since 2020, and that USPTO patents awarded annually to U.S. owners have declined since 2019[4]. This decrease in patent application activity indicates a shift in strategy, and supports a broader trend toward leveraging open standards and collaborative practices to drive technological advancement and achieve market success.
The Linux Foundation family of projects operate with a range of patent policies, from Reasonable and Non-Discriminatory, with

or without royalties, and community developed licensing terms[5], that are compatible with the policies of traditional standards-developing organizations and respect the rights of innovative patent holders. Our perspective on standardization is informed by these myriad projects as well as the real-world, real-time needs of our Members and their customers. Together with the LF Research team, we have produced this research based on a global survey to gather data from a wide range of organizations. The survey received 235 complete responses from a qualified audience. For more information about the survey methodology and demographics, please refer to the "About the Survey" section at the end of this report.

This report reexamines the role of patents and the advantages of open standards. We start by assessing the value of standardization for organizations and industries. Then, we investigate the preferred standard characteristics and the benefits and challenges of contributing to standards development. Finally, we critically analyze patent effectiveness and motivations in this context. As industries continue to interconnect and digital transformations become more pervasive, the report aims to support policy and strategic business decisions for investing in standardization activities and open technologies.

Organizations strongly value standardization

A majority of organizations perceive standardization as highly beneficial for a number of reasons. As depicted in Figure 1, an overwhelming majority of respondents (80%) agree that **standardization facilitates compliance and regulatory requirements.** The very nature of a standard describes a set of rules that should be followed in order to achieve an outcome, which makes it simpler for organizations to demonstrate compliance with regulatory requirements or conformance to expected behavior. Standardization provides not only a clear framework and common language for interpreting and implementing technologies, but also a mechanism for clarification, feedback, and review of requirements. This loop from requirement to implementation to conformance (and back) makes it easier to spot gaps, plug holes, and modify where needed. The benefits of being an active participant in standardization is self-evident, whether it's in the routine work of product interoperability or more exceptionally, in harmonization.

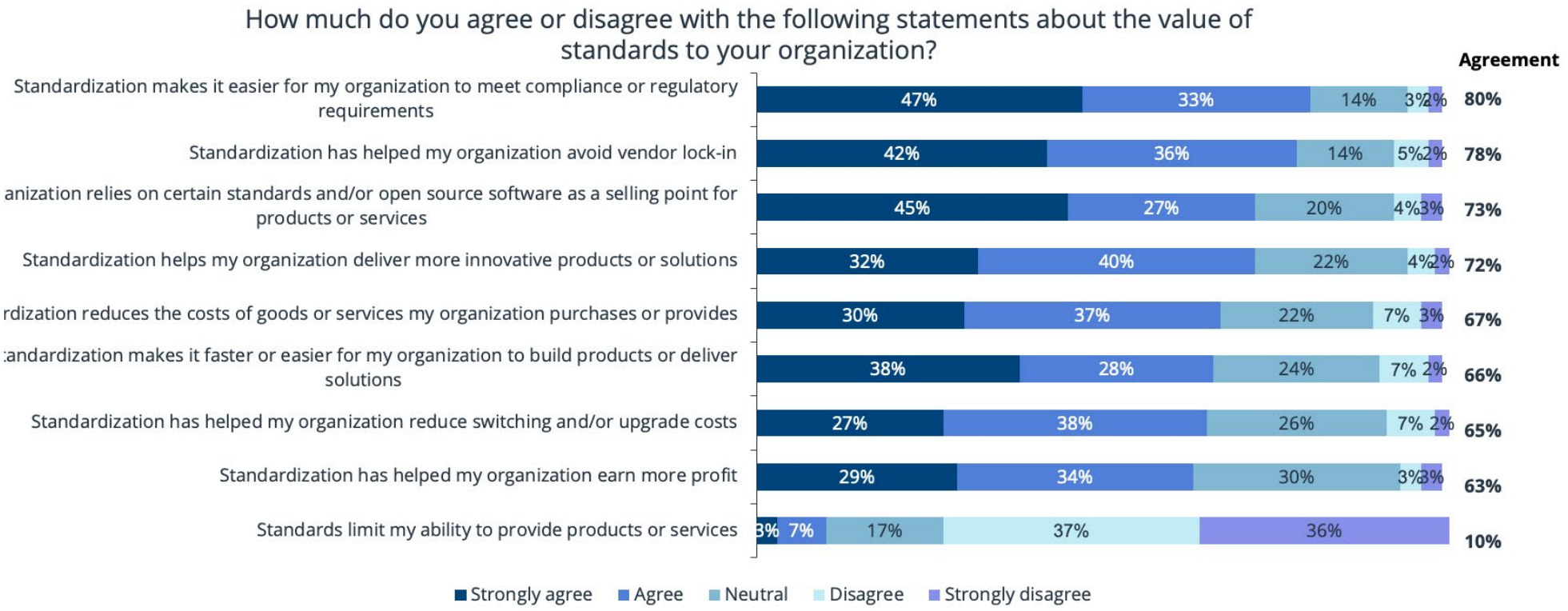
Avoiding vendor lock-in (78% agreement) **and using standards as a selling point** (73% agreement) **are highly valued commercial benefits of standardization.** Both benefits are related to the compatibility or interoperability function of standards, which increases competition and creates positive network externalities. It helps that most organizations today are both buyers and suppliers - they themselves do not want to be tied to a single supplier or cut off from an important integration. As technology buyers, they are often savvy enough to maintain flexibility in their technology choices, and as technology builders, they recognize that these characteristics are valued by potential customers and thus useful in sales and marketing activities.

A strong majority of respondents agreed that **standardization provides concrete benefits to organizations by reducing costs of goods or services** (67%), **speeding up delivery** (66%), **and reducing switching costs** (65%). **provide concrete benefits. Enabling more innovative products** (72% agreement) and earning more profit (63% agreement) are also frequently reported benefits. Standards foster collaboration across organizations and free up resources to develop new features or solutions, while ensuring those innovations will be compatible with existing systems and processes.

Interestingly, only a small minority (10%) of organizations feel that standards limit their ability to provide products or services. This suggests that most organizations see standardization as a tool for improvement and fair competition rather than a constraint on their capabilities.

FIGURE 1

MOST ORGANIZATIONS PERCEIVE STANDARDIZATION AS HIGHLY BENEFICIAL, WHILE A MINORITY VIEW IT AS LIMITING THEIR ABILITY TO PROVIDE PRODUCTS OR SERVICES



2024 Open Standards Survey, Q17, Sample Size = 235, DKNS excluded from the analysis

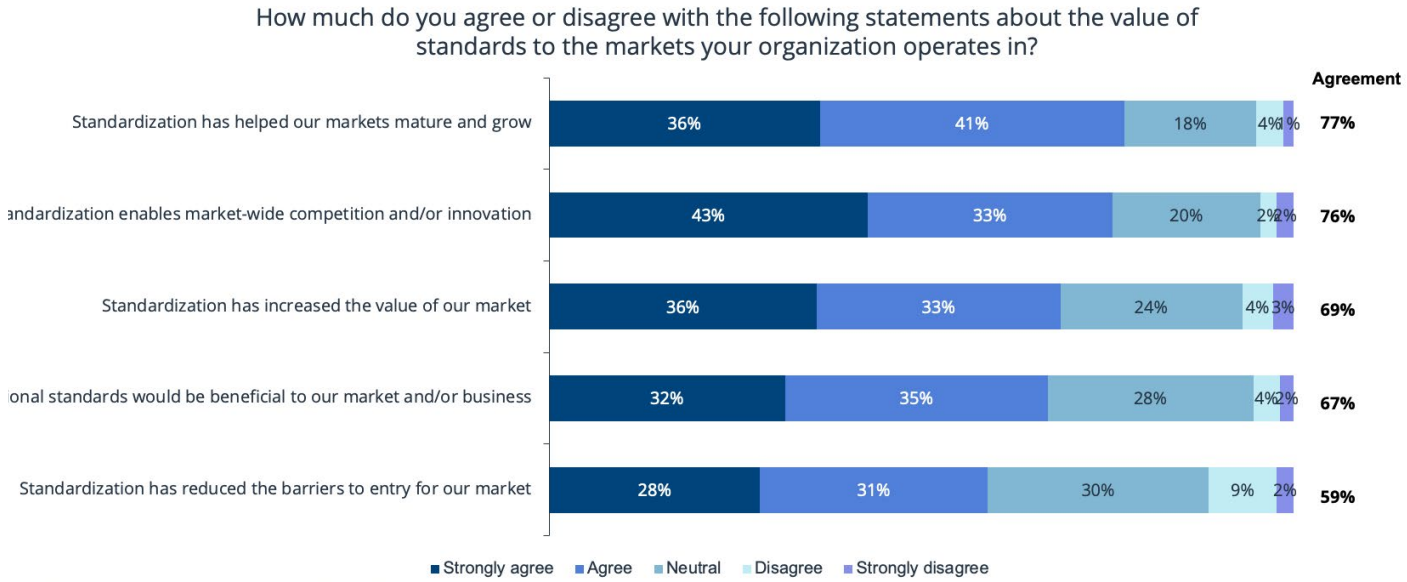
Standardization also positively impacts the market

Standards provide individual and collective benefits - the more people who use the standard, the more value it has. As shown in Figure 2, the majority of respondents agree that standardization has created positive network externalities for their markets, such as **helping them mature and grow** (77% of agreement), **enabling competition and innovation** (76% of agreement)**, increasing market value** (69% of agreement), **and reducing barriers to entry** (59% of agreement). A substantial number of respondents (67%) even agreed that additional standards would be beneficial to their markets and/or businesses. This suggests that organizations see standardization as a mechanism that enhances overall market dynamics by ensuring fair competition and encouraging the entry of new players and innovations. Ultimately, standardization contributes to a healthier, more competitive market that benefits both consumers and businesses.

The benefits of standardization for organizations and markets are evident across tech sectors. Figure 3 illustrates the average agreement on the benefits of standardization across various tech sectors. Standardization is widely recognized as beneficial across all analyzed technology domains, with agreement levels ranging from 60% to 79%. Infrastructure and data lead the pack with 79% agreement, closely followed by telecommunications at 78% and emerging tech (including fintech, biotech, and cleantech) at 76%. Software development (70%), hardware semiconductors (68%), and data manipulation and analysis (66%) also show strong positive sentiment towards standardization. A clear majority agreement is even present in sectors like industrial robotics/IoT/manufacturing (62%) and cybersecurity (60%), where one might expect more customized products and services. This finding indicates that standardization has been fully associated with the innovation agenda[6] throughout the technology industry.

FIGURE 2

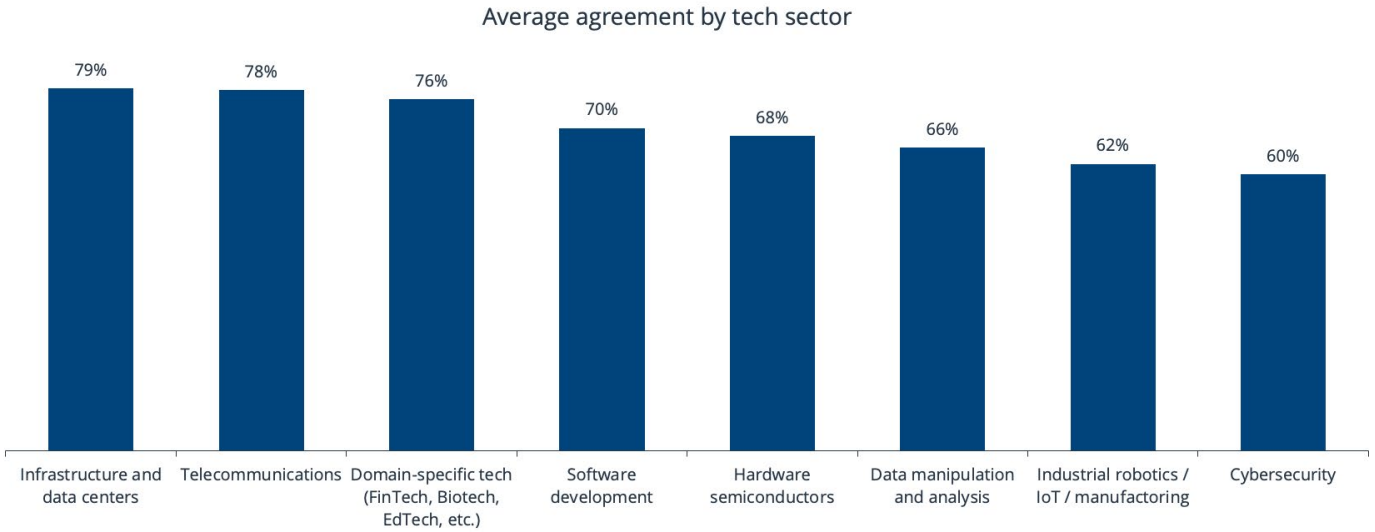
MOST ORGANIZATIONS AGREE THAT THEIR MARKETS BENEFIT FROM STANDARDIZATION



2024 Open Standards Survey, Q18, Sample Size = 235, DKNS excluded from the analysis.

FIGURE 3

STANDARDIZATION BENEFITS THE WHOLE TECH INDUSTRY



2024 Open Standards Survey, Q18 by Q7, Sample Size = 118, Total Mentions = 423. Questions answered by IT vendors. Similar sectors were grouped. Only groups with at least ten responses are shown.

Organizations value open standards attributes

Our previous report found several attributes that were deemed to be necessary for open standards. This report builds on those findings. As shown in Figure 4, attributes typically associated with open standards drive the most value for organizations from the standards they implement. Open standards are developed through a collaborative and transparent process that encourages the participation of a wide range of stakeholders, including industry experts, companies, academia, governments and public institutions. Other characteristics that were deemed necessary for an open standard in our 2023 study included the final specification being openly published and accessible, being royalty-free for implementers, and being free from clauses that limit or confuse.

We asked survey participants to share how much value is driven by these and other attributes. Not surprisingly, 78% of respondents place a very high or high value on **royalty-free standards.** By comparison, a mere 19% highly value royalty-bearing standards. In addition to reducing costs, adopting royalty-free standards may also reduce risk, implementation friction, and operational complexity for organizations. Other IP considerations also rank highly, with 71% of respondents valuing **clear, easy-to-understand IP agreements** and 64% appreciating **clear patent licensing terms.** The responses reinforce the preference by organizations for standards that do not cause confusion or limitations for implementers. This emphasis on clear IP agreements and patent licensing terms reflects the value of IP clarity and predictability in implementing standards, enabling companies to make informed decisions about their technology investments without the risk of legal or financial surprises.

Respondents also highly value open standards characteristics related to accessibility of the specification, with 76% of respondents placing great significance on **openly published and publicly accessible specifications.** Additional closely linked, high-value attributes for organizations included transparency in the development process and undergoing wide review, valued by 68% and 66% of respondents, respectively. These attributes provide direct value to organizations because they make it easier to assess whether the standard will be fit for purpose. **Extensibility and compatibility** with other specifications may be part of that assessment, with 70% of respondents agreeing that these aspects drive value. Organizations value standards that are designed to integrate into their existing systems, and that are likely to remain relevant even as technologies change. The System Package Data Exchange (SPDX) standard[7] is one such example: as Software Bills of Materials are increasingly mandated, SPDX provides an extensible way to represent software components even as they change in the face of new technologies like AI. SPDX is a freely available ISO/IEC standard.

Multi-stakeholder management (67%) was also a high value attribute for organizations. While working cooperatively on a standard with potential competitors may seem counter-intuitive, such efforts provide mutual benefits such as sharing investment in core infrastructure and bringing higher-quality products to the market. Interestingly, while multi-stakeholder engagement was a top value driver, the specific standards developing organization or companies involved in creating the standard did not appear to drive as much value for organizations, comparatively speaking (52% and 45% agreement, respectively). Still, these findings reflect the importance of collaborative and open development processes in creating and managing valuable standards for organizations.

Collaborative approaches ensure that the resulting standards address a wide range of needs and use cases, fostering broader adoption and longevity. The development of Internet protocols by the Internet Engineering Task Force (IETF)[8] exemplifies this multi-stakeholder model, where individuals from various organizations and backgrounds work together to create robust, widely-accepted standards. Such approaches typically take more time, and this is reflected in the finding that only 31% of respondents see high value in standards developed quickly (in less than a year). In prioritizing other aspects, organizations ensure that the standards are robust, well-considered, and capable of meeting the long-term needs of various stakeholders.

FIGURE 4

ATTRIBUTES COMMONLY FOUND IN OPEN STANDARDS PROVIDE MORE VALUE TO ORGANIZATIONS

2024 Open Standards Survey, Q14, Sample Size = 235, sorted by very high value + high value. DKNS excluded.

Organizations value open standards attributes differently

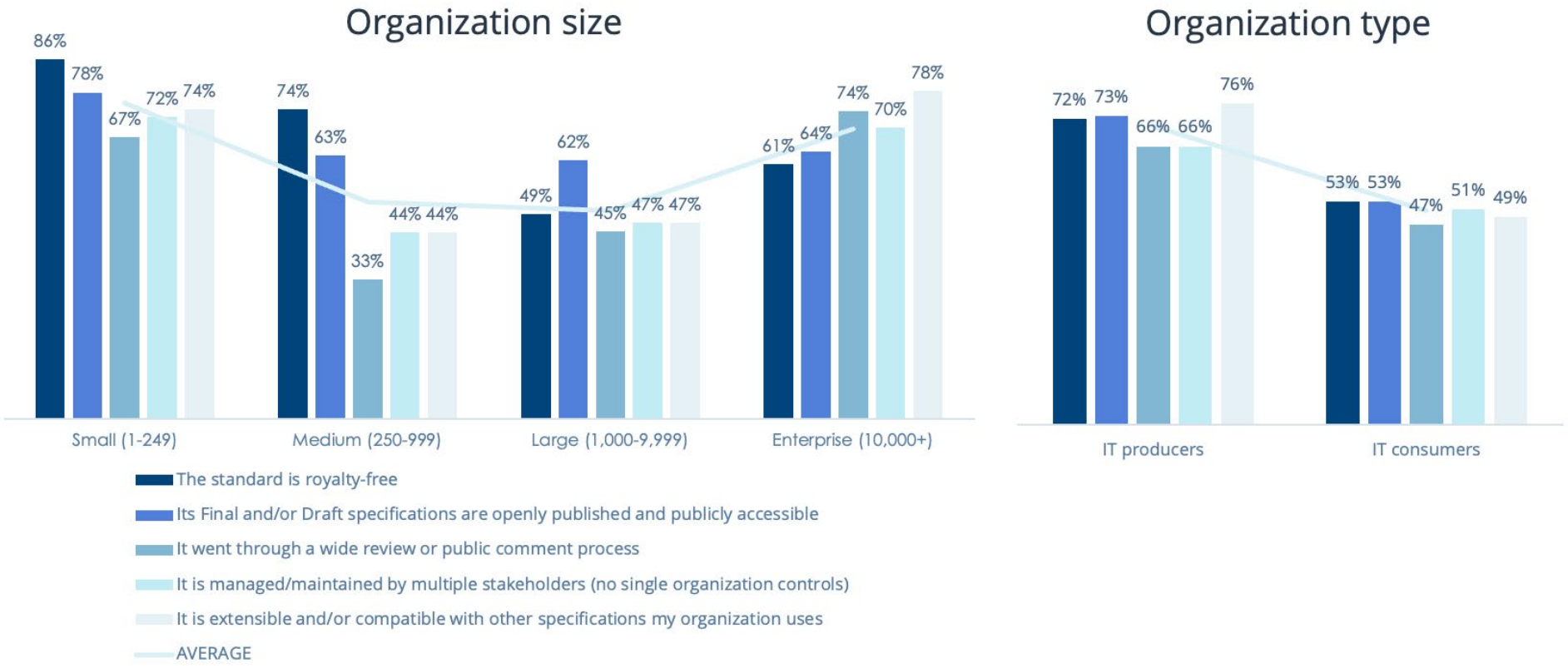
The survey results reveal clear patterns in how organizations of different sizes value attributes of open standards, as observed in Figure 5. Small and Enterprise organizations consistently show the highest levels of appreciation for all attributes of open standards. Small organizations especially valued royalty-free standards (86%) as well as openly published and accessible specifications (78%). This suggests that smaller entities, likely operating with limited resources, find significant value in standards that are easily evaluated for technical and licensing concerns. Small teams within an Enterprise setting also benefit from these attributes; however they are more likely to have access to additional corporate resources, such as memberships in industry groups, licensing to access non-public documents and materials such as journal databases, and in-house legal support. For enterprise organizations, extensibility or compatibility (78%) and wide review (74%) are attributes that drive the highest value. Both small and enterprise organizations placed similar levels of value on multi-stakeholder management (72% and 70% respectively). This finding indicates that both groups value the pro-competitive benefits of standardization.

We see some significant changes in which attributes drive the most benefits as we move up the organizational scale. Like their smaller counterparts, medium-sized organizations also place the highest value on royalty-free (74%) and openly published standards (63%). However, medium and large-sized organizations were more similar in their assessment of the other attributes. While openly published standards were seen as high value (62%) to large organizations, large organizations reported lower overall value across attributes. Medium (33%) and large (45%) organizations also rated the value of wide review or public comment processes lower than their small and enterprise counterparts. One explanation for this might be that because time is a scarce resource for medium and large organizations, wide review and public comment processes are seen as too expensive an undertaking. Meanwhile, for enterprise organizations, these attributes indicate that a standard has been thoroughly vetted, and may be more likely to ensure robustness, security, and broad applicability across their extensive operations.

The survey also reveals significant differences in IT producers' and consumers' perspectives on open standards. Organizations predominantly identifying as IT producers consistently show higher percentages across all attributes compared to those predominantly identifying as IT consumers. This disparity is most pronounced in attributes like extensibility (76% for producers vs. 49% for consumers) and openly available specification (73% vs. 53%). These characteristics allow producers to create flexible and interoperable solutions, expanding their market reach and reducing time-to-market. Applied to interoperability standards in particular, open standards attributes enable IT producers to more easily integrate their products with other systems and platforms, enhancing their offerings' compatibility and appeal in a diverse technological landscape. Conversely, IT consumers might focus more on immediate usability and cost-effectiveness, possibly explaining their relatively lower emphasis on aspects of open standards related to review and governance. IT producers also show a notably higher appreciation for royalty-free standards (72% vs. 53%), likely because this IP regime is easier to factor into product development and market strategies. This supports our earlier finding that standardization is a highly valued selling point of products and services.

FIGURE 5

VALUE OF OPEN STANDARDS ATTRIBUTES FOR ORGANIZATIONS OF DIFFERENT TYPES AND SIZES



2024 Open Standards Survey, selected Q14 items by Q6 & Q9, Sample Size = 226. The percentage represents the number of respondents who selected high or extremely high value.

Open standards attributes promote wide-spread adoption

In **FIGURE 1**, As stated earlier in the report, broad adoption of a standard is the chief indicator of its success. In evaluating specifications for adoption, the most critical factor for organizations is whether it has been **widely reviewed** for security, privacy, or other safety concerns, as observed in Figure 6. An overwhelming 75% of respondents rated this as extremely or very important in the specifications they select, perhaps because doing such an analysis on one's own isn't cost-effective or feasible. Wide review of a specification gathers expertise and perspectives organizations may not otherwise have access to, broadening benefits for the organization, their customers, and society. This is particularly relevant when it comes to safety standards, where the applicability of a specification to **meet regulatory or other criteria** was also considered extremely or very important (68%) for adoption. The increasing risks of

cyber threats, cost and consequences for data protection, and mounting regulatory requirements for user privacy and security of digital products drives organizations to prioritize standards that have these attributes and can be objectively incorporated into their own supplier requirements. Interestingly, other attributes that contribute to meeting regulatory or other criteria, such as certification, conformance, or compliance programs and commercially available 3rd party support were not nearly as important to respondents comparatively speaking. The review process for open specifications, particularly those that will be incorporated into national standards typically involves diverse stakeholders from various organizations, industries, and even geographical regions, contributing to a more comprehensive vetting of the standard. This collective approach not only helps identify potential vulnerabilities or limitations but also fosters greater credibility in the standard. The emphasis on wide review also complements other highly valued aspects of open standards, such as the **presence of an active and engaged community** (67% extremely/very important) and **frequent updates or maintenance** of the specification (66% extremely/very important).

The second most valued factor is the availability of public **technical support documentation**, tutorials, or other non-specification materials, with 71% of respondents considering this extremely or very important. This finding also connects to socialization elements as discussed in the previous paragraph. Well-documented standards with robust support materials can significantly reduce the barriers for implementers, potentially speeding up adoption rates and ensuring more consistent implementation across different organizations. Interestingly, other "social" attributes such as which standards-developing organization published the standard (47%) and whether the specification has been implemented at similar organizations (54%) were not as relevant, indicating that "who" is engaged is less important than "how much" they're engaged.

The availability of the specification under **royalty-free licensing terms** comes in third place, with 68% of respondents considering this very or extremely important. As discussed in the previous section, the high value placed on royalty-free licensing indicates that this attribute addresses several important considerations for organizations, including managing costs, reducing risks, and simplifying IP strategies.

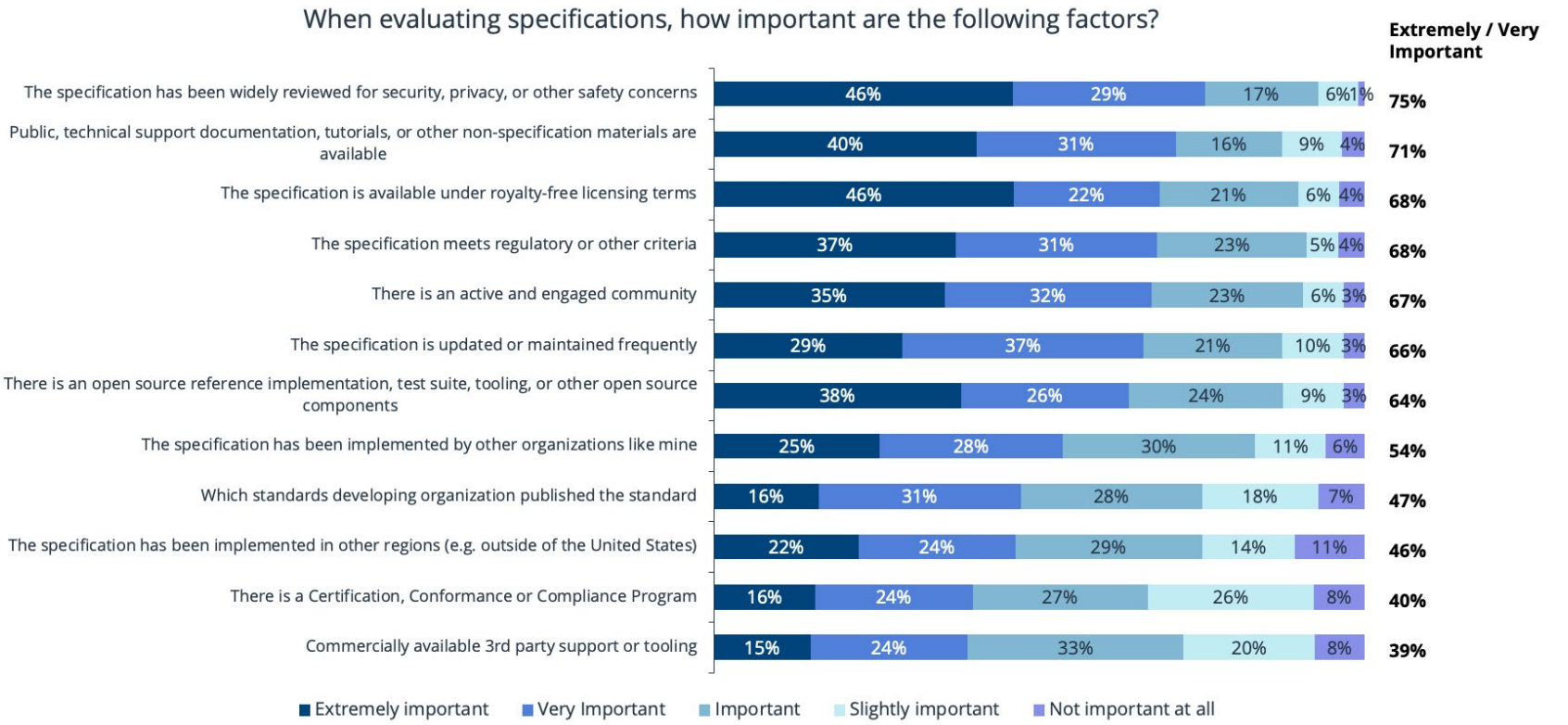
The survey results also shed light on the importance of **open source** in the context of open standards. With 64% of respondents considering an open source reference implementation, test suite, testing, or other open source components as extremely or very important, it's evident that open source plays a significant role in adopting and implementing open standards. One example of this reciprocally beneficial connection is that of the royalty-free Open Charge Point Protocol (OCPP) standard[9] and the LF Energy EVerest[10] open source software stack. Combined, these open technologies are helping to accelerate adoption and decrease costs for electric vehicle charging.

Open source implementations serve as practical, accessible examples of how to correctly implement a standard, reducing ambiguity and accelerating adoption. Open source tools connected to a specification are seen as valuable resources for developers looking to integrate the standard. This open approach fosters a vibrant ecosystem where improvements, bug fixes, and extensions can be shared freely among open source and commercial providers, ultimately leading to more robust, widely adopted, and innovatively implemented standards.

These findings emphasize the value organizations place on standards that are supported by an engaged community that reviews specifications, produces documentation, addresses compliance requirements, provides open-source reference implementations and tools, and maintains the standard. It is clear that attributes commonly found in open standards make a specification more attractive to organizations, facilitating its widespread adoption.

FIGURE 6

MOST IMPORTANT FACTORS CONSIDERED BY ORGANIZATIONS WHILE EVALUATING A STANDARD



2024 Open Standards Survey, Q15, Sample Size = 235, sorted by extremely important + very important, DKNS excluded

Open standards factors are important for all organizations

We next examine whether an attribute's importance will vary based on size or type. Consistent with our findings in Figure 5 which showed that different organizations prioritize different factors, we find that open standards attributes consistently occupy top positions regardless of organization size and type, as observed in Figure 7.

Royalty-free licensing decreases in importance as organization size increases, while compliance concerns increase. Factors such as the importance of being widely reviewed are especially important for small (1-249) and enterprise-level (10,000+) organizations.

The availability of public materials and the existence of an active and engaged community consistently rank among the most important factors, although their priority shifts depending on the organizational size.

Interestingly, open source components are especially important for organizations that primarily consume IT products and services. Coupled with the importance of the availability of public materials,

ranked second, this indicates that IT Consumers benefit from the availability of a reference implementation and supporting tools. The transparency offered by open source solutions allows these organizations to better understand the technology and confirm that it will fit their specific needs. Attributes such as royalty free licensing and available commercial support were ranked as least concerning to IT Consumers, which suggests that these types of organizations are used to factoring the cost of ownership into their decision-making around technologies.

These patterns demonstrate how organizational needs and priorities shift with size and type, while also revealing some universal values derived from open standards characteristics.

FIGURE 7

MOST IMPORTANT FACTORS FOR DIFFERENT ORGANIZATION SIZES AND TYPES

2024 Open Standards Survey, Q15 by Q9 and Q6, Sample Size = 235, the number in the lines represent the percentages of respondents that selected very or extremely important

Open activities are among top-3 indicators of innovation

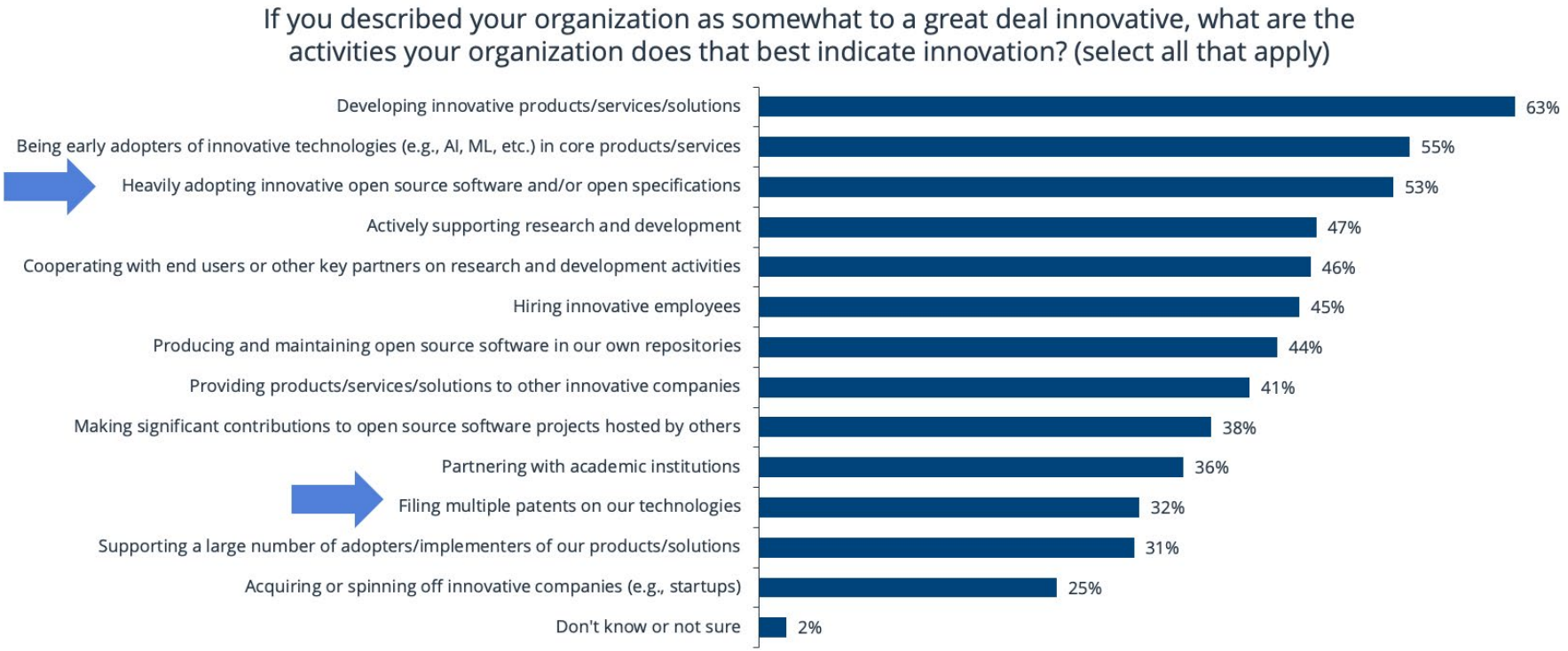
Historically, patent application activity has been used as an output measure of innovation (See Figure 8). Our findings support external findings[11] that this is no longer the best indicator of innovative activity. We asked respondents to describe which activities best indicate innovation. Aligned with the previous findings, cooperative activities such as **heavily adopting innovative open source software and/or open specifications and producing and maintaining open source software** were frequently cited indicators of innovation. Other cooperative activities such as working with end users and key partners on research and development (46%) and being early adopters of innovative technologies which are often built on open source software (55%) also rated in the top 5 indicators.

In contrast, **filing multiple patents** ranks significantly lower on the list, with only 32% of respondents indicating this as a key indicator of innovation. The disparity between the high ranking of cooperative activities and the lower ranking of strategic business decisions such as filing patents or acquiring or spinning off innovative startups (25%) may reflect a shift in how organizations conceptualize and measure innovation. It suggests a move from prioritizing individual speed to collective endurance - away from "solitary genius" mythology towards collaborative approaches where all parties bring something to the table for the benefit of all. The rapidly-evolving nature of technology development coupled with the need to describe safety and compatibility standards that protect and support users has important implications for how organizations might develop innovation strategies.

Table 1 illustrates that key selected indicators of innovation can have surprising characteristics based on organization size and type of organization. Heavily adopting innovative open source software and/or open specifications is uniformly important organization regardless of organization size or type. However, filing multiple patents based on organization technologies is highly correlated based on organization size, more a priority for vendors and less a priority for end users. It can also be noted that IT vendors are more engaged in both of these indicators compared to end users.

FIGURE 8

INDICATORS OF INNOVATION



2024 Open Standards Survey, Q11, Sample Size = 216, Total Mentions = 1,207, question answered only by those at least moderately innovative (Q10)

TABLE 1

RELATIVE IMPORTANCE OF OPEN MODELS AND PATENTS FOR DIFFERENT ORGANIZATIONS

	Small (1-249)	Medium (250-999)	Large (1,000-9,999)	Enterprise (10,000+)	IT Vendor	IT Consumer
Heavily adopting innovative open source software and/or open specifications	2nd (55%)	1st (50%)	2nd (47%)	5th (67%)	3rd (59%)	2nd (45%)
Filing multiple patents on our technologies	12th (10%)	12th (17%)	10th (31%)	6th (56%)	10th (40%)	8th (29%)

2024 Open Standards Survey, Q11 x Q9rv and Q11 x Q6rv, sample size = 216, valid cases = 216, total mentions = 1,207

Organizations view patents as a necessary safeguard

If awarded, patents provide a number of benefits. The most commonly understood benefit is the ability to sell or license the invention described in the patent as a source of revenue and a means to prevent others from doing the same. Patents are instruments that can be used to recoup R&D investments, secure loans, or qualify for tax breaks and are often reflected as assets in a company's financial portfolio.

Defensive patent filing is the dominant strategy employed by many organizations, as reported by 46% of respondents and observed in Figure 9. Companies using this strategy file patents primarily to establish prior art and create a legal shield against potential infringement claims. This strategy functions like an insurance policy and can discourage expensive, lengthy patent litigation. An example of this at work in the open source ecosystem is the Open Invention Network (OIN), a community of 4,000 member companies leveraging 3 million patents and applications to defensively protect several core open source technologies[12]. Crucially, this strategy doesn't prevent organizations from commercializing their patent portfolios - rather, it treats these assets as strategic tools, with value beyond licensing revenue.

In contrast, only 12% of respondents reported that their organization engages in an offensive patent strategy. This more aggressive approach typically involves actively securing patent rights (e.g. by patent fencing[13] or purchasing other portfolios) in order to pursue licensing revenue, create leverage in business negotiations, or control a market. The significant preference for defensive over offensive strategies (nearly a 4:1 ratio) suggests that most companies view patents as a protective asset rather than a direct revenue generator or driver of competitive advantage in innovation.

This finding aligns with the emphasis on open innovation and collaborative development in many industries, where maintaining good relationships and fostering ecosystems can be as important as protecting proprietary technology. Membership growth of organizations such as OIN and Unified Patents[14], an organization that challenges questionable patents, indicates strong support for combating patent trolls and improving patent quality.

FIGURE 9

THE MOST COMMON STRATEGY ORGANIZATIONS EMPLOY IS A DEFENSIVE PATENT STRATEGY

2024 Open Standards Survey, Q19, Sample Size = 178, DKNS excluded

Monetizing Standards Essential Patents is not a great return on investment for most organizations

The survey results reveal a significant skepticism about the value of royalties and fees for licensing standards-essential patents (SEPs) among organizations. This sentiment is evident across all three statements presented, with disagreement levels ranging from 56% to 70%, as observed in Figure 10. This finding corroborates earlier research on motives for patenting, which found that generating license fees and influencing standardization activities were among the least important motives for patenting[15].

Most respondents (56%) disagree that royalties and fees from licensing Standard Essential Patents (SEPs) provide a great return on investment for their organizations. Similarly, most respondents (61%) also disagree that SEP licensing fees are necessary to enable new technical investments or innovations, which challenges the notion that monetizing SEPs is a key driver of industry progress. Organizations that invest in innovation will likely continue to do so in order to remain relevant and competitive, regardless of whether they are collecting fees from SEPs. Finally, an overwhelming 70% of respondents do not view royalty-free standards as threatening to their business models. These responses indicate that most organizations prefer more strategic approaches to managing their patents for inventions in specific domains, and that there are greater gains to be had making SEPs available without exacting fees. Further, it suggests that standardization delivers more value to the

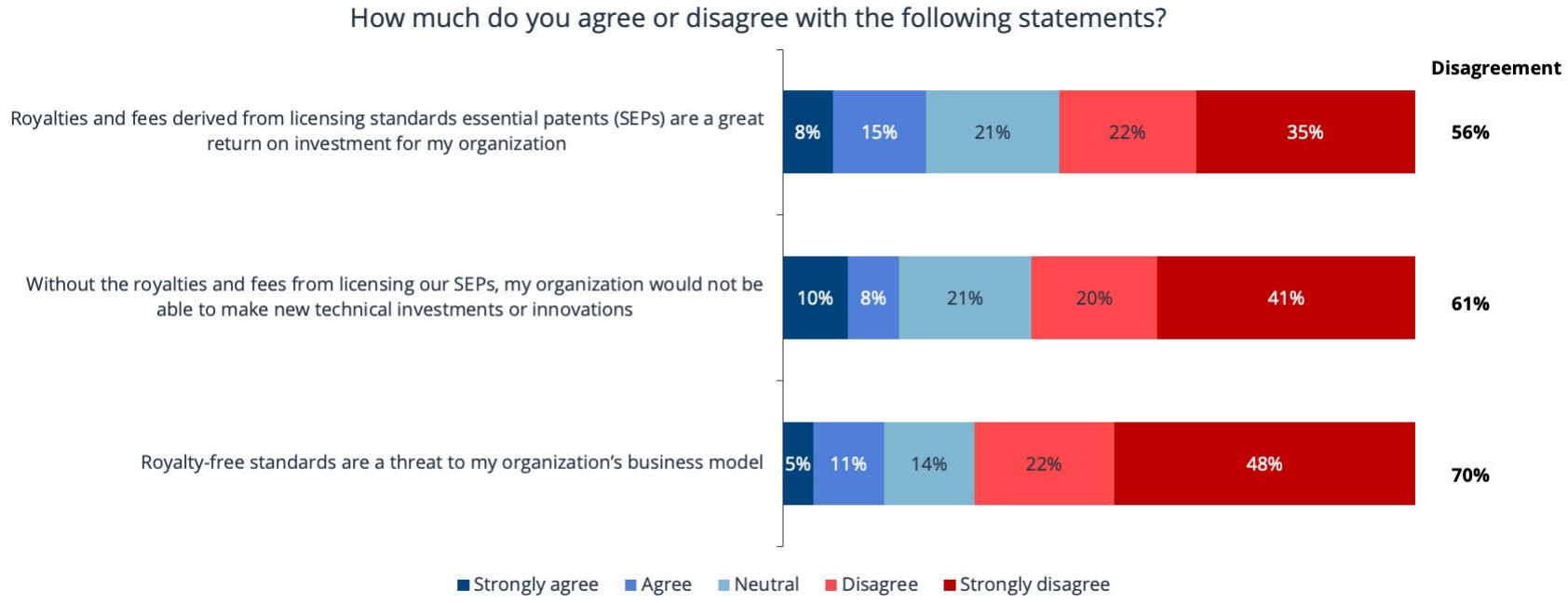
organization through the attributes described earlier in this report than would be realized only through monetization.

Figure 11 analyzes these responses based on the organization's patent strategy. We can observe that even organizations that would theoretically gain the most from monetizing SEPs - those that engage in offensive patent strategy and have more than 20% of revenue from SEPs a) do not consider SEPs a great return of investment and b) would continue to make new technical investments or innovations without royalties and fees from licensing SEPs. Unsurprisingly, these organizations were more likely to perceive the greatest threat from royalty-free standards, however that agreement was not overwhelming (29% and 55% respectively).

Interestingly, organizations that derive 1-20% of revenue from SEPs strongly disagreed that royalty free standards are a threat (72%) but were also most likely to agree that royalties from SEPs are a great return on investment (61%). These results indicate that, while SEPs are strategic assets regardless of approach, they are more valuable to organizations for their non-monetary benefits. De-risking open technologies by participating in patent non-aggression communities like OIN or making SEPs available to implementers on a royalty-free basis provides strong organizational benefits while protecting the innovation and preserving the rights of the inventor. In turn, the organization gains reciprocal benefits from other stakeholders who are also taking a more strategic, mutually beneficial approach. Ultimately patent application strategy and portfolio management are business decisions rather than technical ones, and SEP licensing revenue doesn't provide the highest ROI.

FIGURE 10

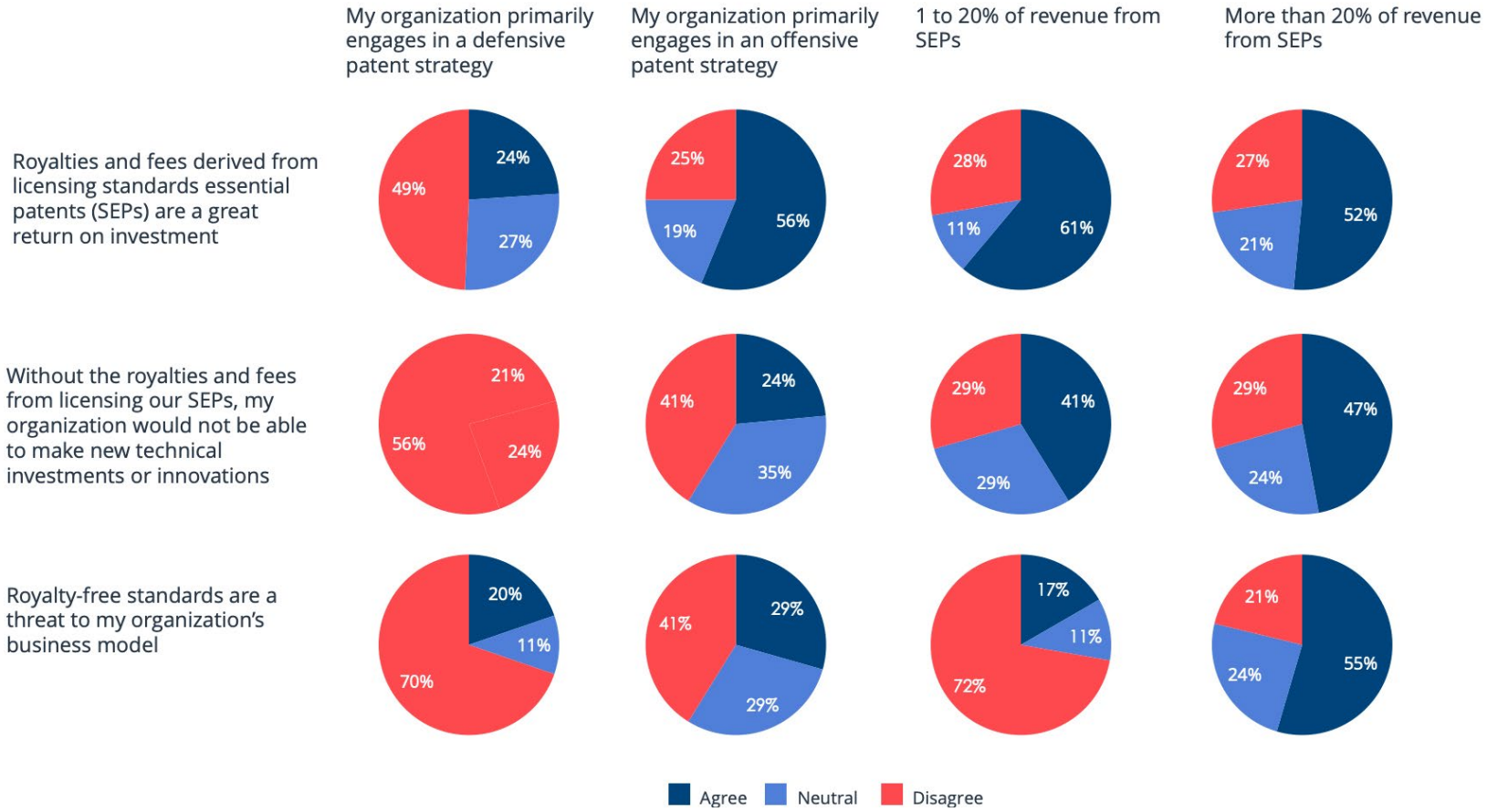
ORGANIZATIONS' PERSPECTIVES ON PATENTS



2024 Open Standards Survey, Q16, Sample Size = 235, DKNS excluded

FIGURE 11

ORGANIZATIONS PERSPECTIVES ON PATENTS PER TYPE OF ORGANIZATION



2024 Open Standards Survey, Q16 x Q19 (sample size = 190) and Q16 x Q22 (sample size = 132)

Protectionism or intellectual property concerns are not major obstacles to contributing to standards

Organizations report a few obstacles to participating in standards development, as described in Figure 12. Interestingly, factors related to geopolitical protectionism or intellectual property concerns rank low on the list of obstacles. Only 19% of respondents cited a fear of leaking intellectual property, and just 10% indicated a desire to keep their organization's technology limited to their own country. The low ranking of these concerns may reflect a growing recognition of the value of standards in driving global interoperability in today's

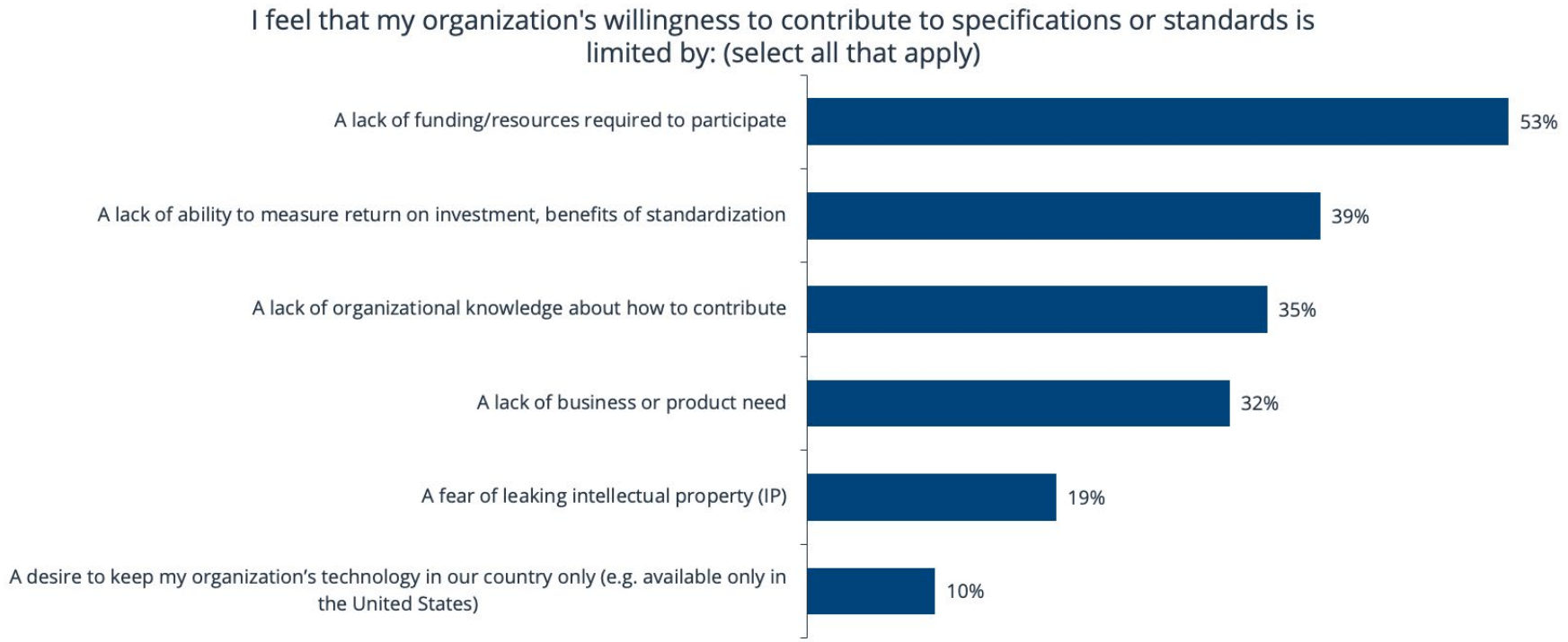
interconnected markets.

Lack of business or product needs ranks relatively low (32%) as well, indicating that organizations recognize a need but may be limited by other factors. The most significant obstacle to contributing to standards, cited by 53% of respondents, is a lack of funding or resources, which scores significantly higher than a lack of business or product need. It suggests that many organizations, particularly smaller ones, may find it challenging to allocate the necessary means for active participation, even with the full awareness of the benefits cited in the previous section.

Ability to measure ROI or benefits of standardization (39%) and lack of organizational knowledge about how to contribute (35%) were selected frequently. This finding highlights an opportunity for standards developing organizations and their communities to collaborate on materials that might help organizational decision-makers gain the information or institutional knowledge necessary to participate.

FIGURE 12

OBSTACLES TO PARTICIPATING IN THE DEVELOPMENT OF STANDARDS



2024 Open Standards Survey, Q25, Sample Size = 174, Total Mentions = 390

Organizations gravitate toward royalty-free standards development processes

A significant majority (66%) of respondents report that their organizations primarily participate in standard development organizations (SDOs) with a royalty-free patent licensing structure, as observed in Figure 13. In contrast, only 26% of organizations primarily engage with SDOs offering multiple patent licensing options, suggesting a smaller but notable segment that values flexibility in licensing arrangements. The least common approach, as reported by just 9% of respondents, is participation in SDOs with a FRAND (Fair, Reasonable, and Non-Discriminatory) patent licensing structure. FRAND policies have traditionally been seen as a balanced approach to handling SEP licensing in standards. However the complexity of these licensing arrangements can be time consuming to negotiate and introduces opportunities for such IP policies to become unclear. Other factors such as the cost of legal review or opportunity costs associated with delays bringing the technology to market may be shifting preferences towards SDOs that have more options or that offer common royalty-free patent licensing modes.

The strong utilization of royalty-free licensing policies in standards development supports a broader movement towards collaborative innovation and knowledge sharing. This trend supports our finding that organizations prefer and prioritize standards with open attributes that can increase adoption and interoperability over potential patent royalty income. It also indicates that companies may view their participation in standards development as a strategic investment in ecosystem growth and market expansion rather than a direct revenue opportunity through patent licensing. This approach could lead to faster innovation cycles, broader market adoption of new technologies, and potentially more robust and widely implemented standards across industries.

FIGURE 13

ORGANIZATIONS PREFER TO PARTICIPATE IN STANDARDS ORGANIZATIONS WITH ROYALTY-FREE PATENT LICENSING STRUCTURES

2024 Open Standards Survey, Q21, Sample Size = 129. DKNS excluded.

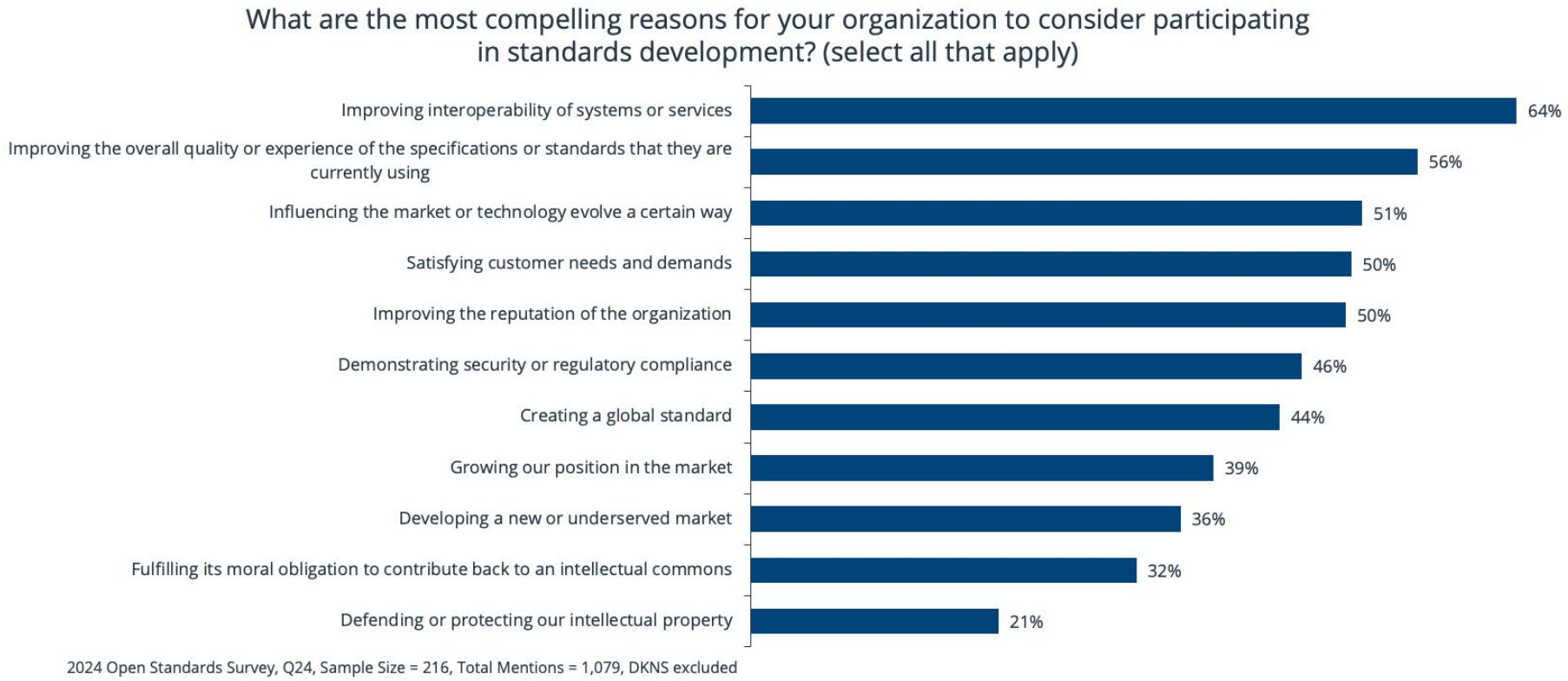
Participating in standards development provides multiple benefits for organizations

As depicted in Figure 14, our results show a multitude of technical, strategic, and ethical considerations that motivate organizations' engagement in developing standards. I**mproving the interoperability of systems or services** emerges as the most compelling reason, cited by 64% of respondents. Following closely, 56% of organizations are motivated to participate in order to i**mprove the quality of the standards they use.** Standards development is an iterative process that encourages continuous improvement, and organizations are interested in improving the standards they use since this would directly benefit their products or services. Strategic business considerations also play a significant role in driving participation. 51% of respondents aim to **influence how the market or technology evolves,** while 50% participate to **satisfy customer needs and demands.** Equally important is the goal of **improving organizational reputation,** also cited by 50% of respondents. These findings suggest that participation in standards development is viewed not just as a technical necessity, but as a strategic business move that can improve market position, customer satisfaction, and corporate image. Nearly half of organizations are compelled to participate in order to engage with policy or regulations, which gives them an opportunity to shape how they will demonstrate compliance. In the case of standardization directives These highly-cited motivations also evidence that standards play an essential role in shaping industry dynamics and competitive landscapes.

Protecting intellectual property ranks lowest at 21%, which aligns with earlier findings that organizations employ nuanced strategies for IP management - baking essential IP into a standard is not the main goal of innovative companies. It's also noteworthy that nearly one third of organizations cite **fulfilling a moral obligation** to contribute back to an intellectual commons as a motivation, indicating a sense of corporate responsibility in technological advancement. These trends point to an evolving perspective on standards development, prioritizing collective progress and interoperability.

FIGURE 14

REASONS FOR PARTICIPATING IN STANDARDS DEVELOPMENT



Conclusions

This report enhances our understanding of how organizations perceive and engage with technical standards, particularly emphasizing the value of open standards. The findings challenge historic views on patents and innovation, supporting a new paradigm in technological advancement and market competition. Key insights include:

- Organizations recognize the benefits of standardization to their business and the markets in which they operate. These benefits include compliance, avoiding vendor lock-in, enticing customers, promoting market maturity and growth, and encouraging innovation.
- Attributes typically associated with open standards, such as being royalty-free and having widely reviewed specifications, are highly valued by organizations of different sizes and industries.
- There's growing skepticism about return on investment for licensing standards-essential patents (SEPs). Most organizations do not view royalty-free standards as a threat to their business models, which challenges traditional notions about the importance of patent licensing fees for funding innovation activity.
- Engagement in open, collaborative activities is seen as a key indicator of innovation, which far outranks filing patent applications. This trend is consistent across different organization sizes and types, suggesting a shift towards more open, collaborative approaches to innovation.
- Organizations predominantly adopt defensive patent strategies rather than offensive ones, viewing patents more as a protective measure than a direct revenue generator or competitive advantage.
- Organizations are primarily motivated to participate in standards development to improve interoperability, enhance the quality of standards they use, and influence market evolution. The main barriers to participating in standards development are resource-related rather than intellectual property or protectionism concerns.

These findings have significant implications for how organizations approach innovation, standardization, and intellectual property management. Organizations should reassess their patent strategies, potentially shifting focus from revenue-generating SEP licensing to value-added services and engagement with other IP regimes, which could yield better returns. Decision makers should consider these trends when developing strategies for technological development and standardization. In particular, small and medium sized organizations as well as IT stand to benefit from developing explicit strategies for engaging with standards , as it levels the playing field and reduces barriers to entry. Strong preference for royalty-free standards suggests that standard-setting organizations might need to reconsider their licensing policies to align with industry preferences and trends. Finally, we suggest an opportunity for organizations to collaborate on materials and messages that help stakeholders make the business case for participating in specific standards.

Methodology

About the survey

This study is based on a web survey conducted by Linux Foundation Research from April to September 2024. The survey aimed to understand organizational involvement in standards and the impact that standards have on organizations.

We broadly advertised the survey to Linux Foundation subscribers, members, partner communities, and social media. To mitigate sampling biases, we also advertised the survey in standards organizations (56 responses) and hired an external third-party panel provider (61 responses). We addressed data quality through extensive prescreening, survey screening questions, consistency checks, and data quality review to ensure that respondents had sufficient professional experience to answer questions accurately on behalf of their organization. After the data quality filtering, our final sample comprised 235 valid responses.

Data collection typically includes respondents from IT vendors and service providers, industry-specific end user organizations, academia, non-profits, foundations, and government organizations. Because we avoid collecting personal information and any personal information that is collected is done so voluntarily by the respondent, we do not control for collecting more than one response per organization. We also generally do not weight our responses by company size, so the impact of larger organizations is still collectively understated. However, we do typically segment our analysis by technological maturity, company size, geographic region, and other variables that enable us to better understand the impact that demographic and technology adoption characteristics have on the data.

The survey comprised 25 questions that addressed screening, respondent demographics, perceptions of innovation, and organizational involvement with standards. The dataset driving the analysis in this report and survey frequencies can be found on Data.World. Table 2 shows the high-level design of the survey.

TABLE 2

SURVEY DESIGN

Question categories	Pages	Questions	Who answered the questions
Introduction	P1		
Demographics	P2 – P4	Q1 – Q10	All respondents
Innovation	P5	Q11	Innovative organizations
Organization's involvement in standards	P6	Q12 – Q25	All respondents

The target audience included respondents who met the following criteria:

- Must be familiar, very familiar, or extremely familiar with how standards and specifications impact the Information Technology (IT) industry, including software, hardware, or product development.
- Must pass an attention check question.
- Must be currently employed by an organization.
- The primary occupation cannot be that of a student.
- Must have professional experience.

A total of 818 respondents began the survey and 305 completed the survey. After data quality screening, the analyzed data set comprises 235 responses. The margin of error for this sample size is +/- 5.38% at a 90% confidence level and +/- 6.39% at a 95% confidence level.

The data was primarily segmented by company size and type of organization.

Although respondents were required to answer nearly all questions in the survey, a provision was made when a respondent was unable to answer a question. This is accomplished by adding a "Don't know or not sure" (DKNS) response to the list of responses for every question. However, this creates a variety of analytical challenges. One approach was to treat a DKNS just like any other response so that the percentage of respondents who answered the DKNS is known. This approach has the advantage of showing the exact distribution of the data collected. The challenge with this approach is that it can distort the distribution of valid responses, i.e., responses where respondents could answer the question. Therefore, most of the analyses in this report exclude DKNS responses. This is because we can classify the missing data as either missing at random or missing completely at random. Excluding DKNS data from a question does not change the distribution of data (counts) for the other responses, but it does change the size of the denominator used to calculate the percent of responses across the remaining responses. This has the effect of proportionally increasing the percentage values of the remaining responses. Where we have elected to exclude DKNS data, the footnote for the figure indicates "DKNS responses excluded from the analysis."

The percentage values in this report may not total to exactly 100% due to rounding.

Data.World access

LF Research makes each of its empirical project datasets available on Data.World. Included in this dataset are the survey instrument, raw survey data, screening and filtering criteria, and frequency charts for each question in the survey. LF research datasets, including this project, can be found at data.world/thelinuxfoundation. Access to Linux Foundation datasets is free but does require you to create a data.world account.

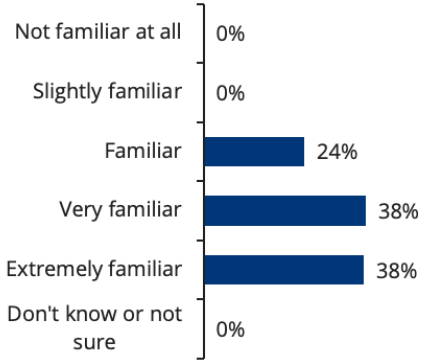
Respondent demographics

Figure 15 presents the respondent demographics. The results indicate a highly experienced and knowledgeable sample group, as 76% of respondents are either "very familiar" or "extremely familiar." An overwhelming 93% have six or more years of experience and more than half (54%) report over 20 years in the field. Regarding roles, there's a relatively even split between business (47%) and engineering (39%) positions. This distribution suggests that the survey captures perspectives from both technical and strategic viewpoints.

FIGURE 15

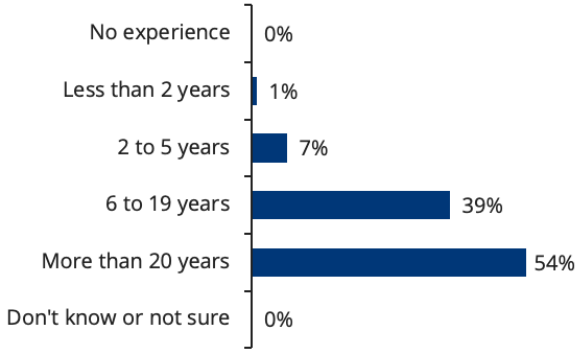
RESPONDENT DEMOGRAPHICS

Familiarity with how standards impact IT



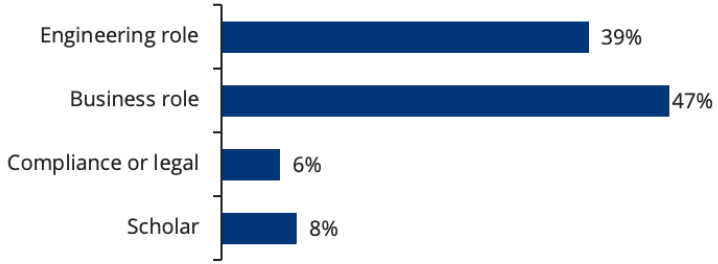
2024 Open Standards Survey, Q1, Sample Size = 235, Not at all familiar, slightly familiar, and don't know or not sure were disqualified.

Professional experience



2024 Open Standards Survey, Q5, Sample Size = 235. No experience and don't know or not sure were disqualified.

Role



2024 Open Standards Survey, Q4, Sample Size = 225

Figure 16 provides an overview of the respondents' organizational profiles. IT providers dominate at 48%. The tech sectors most represented are Infrastructure (20%) and Software Application Development (19%), indicating a focus on core IT services. There is a relatively balanced representation across company sizes from small (35%) to enterprise (23%). Geographically, there's a Western predominance, with 40% from the US or Canada and 30% from Europe, with Asia-Pacific at 24%. This diverse sample, spanning various organization types, sizes, sectors, and regions, offers a broad perspective on the IT industry.

FIGURE 16

ORGANIZATION DEMOGRAPHICS

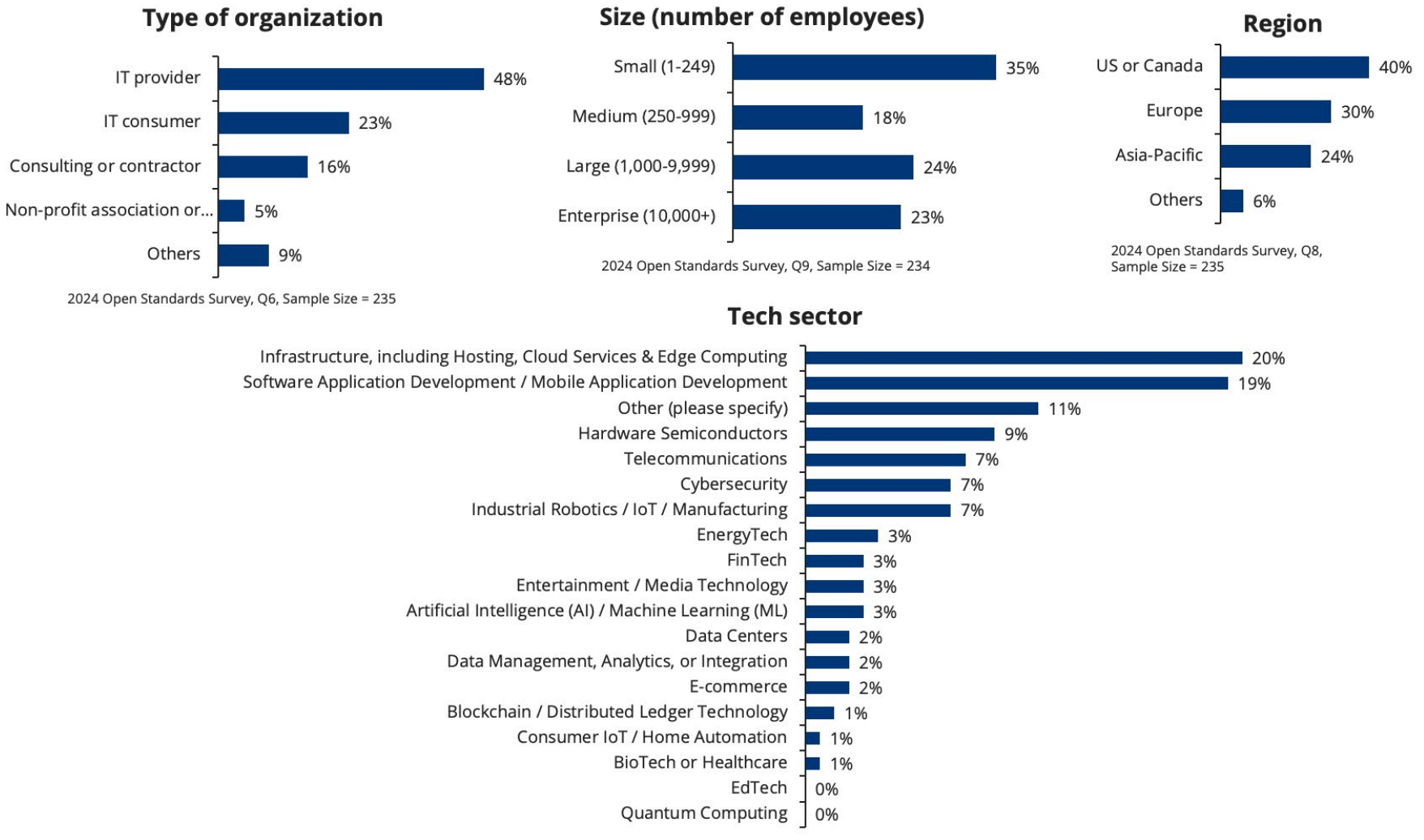
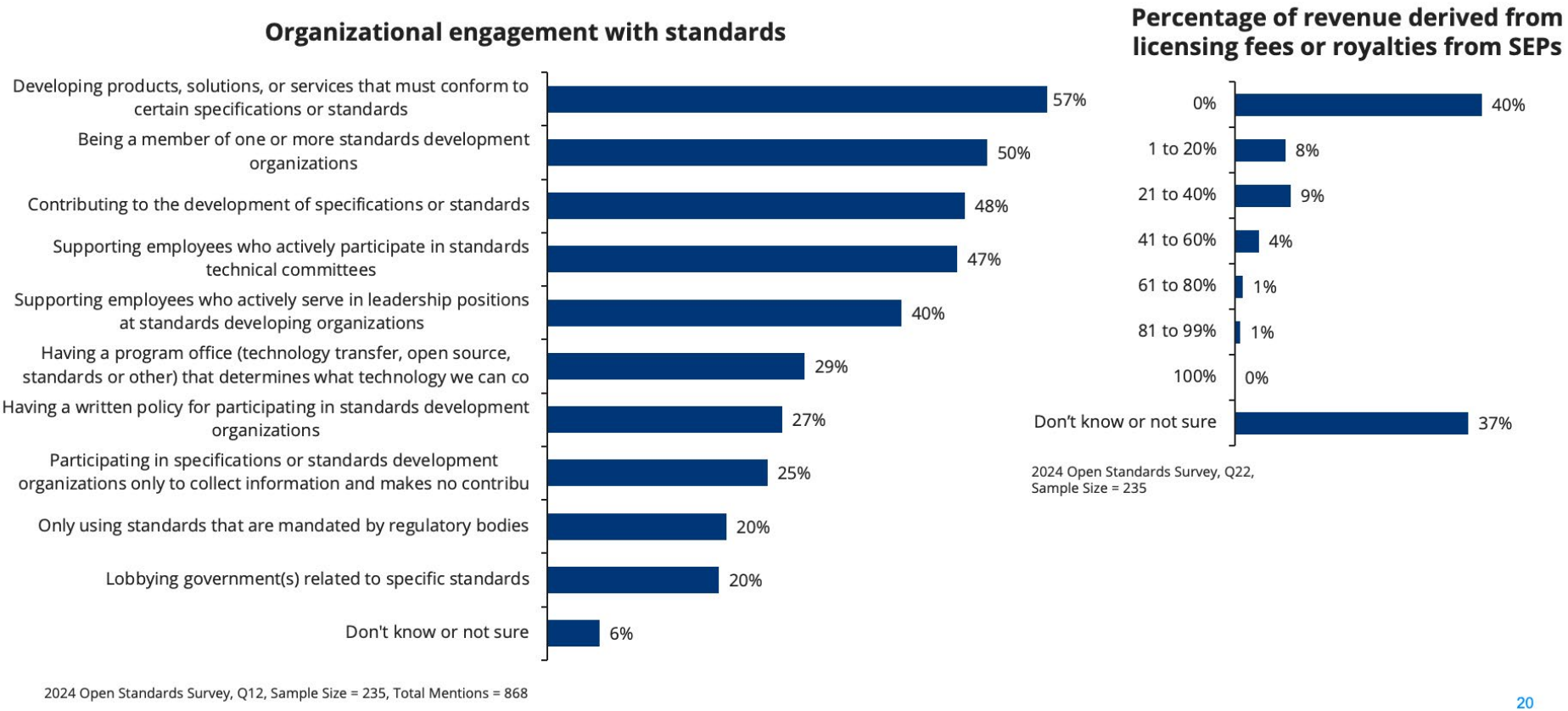


Figure 17 provides insights into organizations' engagement with standards and their revenue from standard-essential patents (SEPs). The left chart shows that most organizations (57%) develop products conforming to standards, and half are members of standards development organizations. There's significant active participation, with 48% contributing to standards development and 47% supporting employee involvement in technical committees. Notably, only 20% limit themselves to mandated standards, indicating widespread voluntary adoption. The right chart reveals that 40% of organizations derive no revenue from SEP licensing fees, while 23% receive some revenue.

FIGURE 17

ORGANIZATIONAL INVOLVEMENT WITH STANDARDS



20

Some demographics have been regrouped to facilitate a more insightful analysis. For the original source data and study frequencies, please see the data.world dataset and access as described above.

Endnotes

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