THE LINUX FOUNDATION | Research

The 2023 State of Open Standards

Empirical Research on the Transition to Open Standards

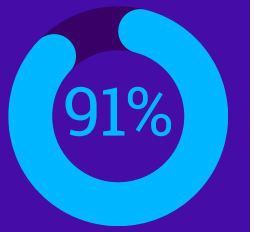
July 2023

Jory Burson, The Linux Foundation

Foreword by Dr. Jochen Friedrich, IBM

The 2023 State of Open Standards

91% of organizations are involved with open standards code

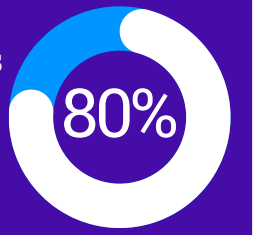


Organizations prefer open standards 7 times more than other standards

Over the last 3 years, organizations are 12 times more likely to say their value from open standards is increasing rather than decreasing

86% of organizations report there is a need for an open standards video streaming codec

80% of organizations state that open standards promote competition



73% of organizations say that open standard benefits outweigh patent royalty opportunities

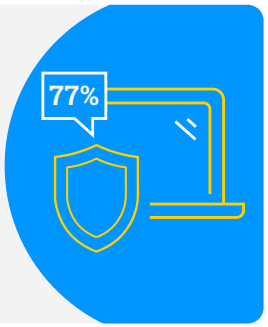
72% of organizations say their customers prefer products and services based on open standards

80% of organizations say that increased use of open standards will make them more competitive

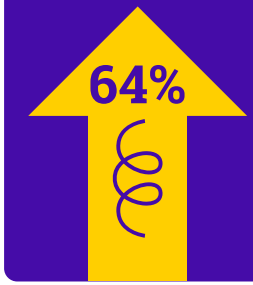
76% of organizations say that increased use of open standards will make them more innovative

#1 Improved productivity is the #1 reason organizations are increasing their use of open standards

77% of organizations say increasing their use of open standards will improve their cybersecurity



64% of organizations say open standards delivered increasing value over the past three years



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Foreword

The world is doomed to innovate. We are in the middle of a major transformation where success no longer lies in simply delivering first-class products and first-class services. What is being demanded and what is urgently needed is delivering first-class products and first-class services in a sustainable way. We are well aware of the challenges societies and economies are facing. We are well aware of the urgency to combat climate change. Sustainability is increasingly becoming the key differentiator and the driving force for innovation.

It is interesting to observe how innovation has become a common objective. For sure, innovation is the basis for competitive advantage in the market. Businesses take investments into R&D, strive for inventions and bring forward innovations for being a first mover and for market success. Yet, innovation is increasingly not something that can solely be done in-house. Innovation in the IT world is increasingly done in open, collaborative ecosystems with all players—industry, public, academia, etc.—working together. Open source software development has been the major driver of innovation in the IT sector. And competitive differentiation takes place on top of those collaborative innovations.

In addition, innovation as a common objective has become a focus topic for governments around the globe. Innovation and openness are critical for tackling the challenges societies and economies are facing. Governments review their policies and regulatory approaches with this perspective. They define respective strategies and implement legal frameworks, aiming at promoting innovation and accelerating the digital and green transformation. And they increasingly recognise the value and benefit of open source and open standards development.

Open source and open standards together shape the open technologies ecosystem in which collaborative technology development and innovation flourish. While it is important to note that open source and open standards are different things, they are intertwined in many ways. Open source software needs to implement standards; open source is the preferred way for reference implementations that support the promulgation of standards and provide rapid feedback loops on functional improvements or identifying gaps; APIs, protocols, etc. are increasingly developed in open source and no longer in the traditional, descriptive way of standardisation; and more. And one point is clear: in this context, only open standards really work well.

Against this background, this report—The 2023 State of Open Standards—that the Linux Foundation Research prepared provides highly valuable insights into needs and expectations regarding standardisation. It illustrates that the role of open standards in IT for addressing the challenges of our time can hardly be overestimated. The report, as it were, sets a new standard for analysis and investigation of the impact of standardisation for the global marketplace. It will appeal to business and technology strategists, academics and policymakers in the same way, supporting informed decision-making as well as new thinking when it comes to what is needed most: driving innovation for business success and for the common good. Congratulations on this great work—I wish everyone an enjoyable read.

Dr Jochen Friedrich, IBM

Introduction

Standards are "recipes for reality" that shape our physical, social, political, and technical worlds[1] and are largely invisible to those most impacted by them from day to day. Effective standards become so ingrained in systems that it seems inconceivable to adopt anything different. This power to define systems and direct decision-making makes it all the more important to study how organizations develop and adopt technical standards. Implicit and explicit decisions made during standardization have enormous implications for high-level issues, such as public policy, security, privacy, and access to global markets, and strategic issues, such as product development and interoperability, quality assurance, and workforce training.

Indeed, there is much at stake when developing standards. That's why Linux Foundation Research, in partnership with the Joint Development Foundation (JDF), Green Software Foundation, OpenUK, Ecma International, OpenChain, SPDX, Trust Over IP, C2PA, GraphQL, and RISC-V International[2], launched this study to understand the state of the practice of standardization in information and computing technology in 2023. The research aims to provide insights into how organizations interpret the strategic value of developing and adopting open standards as part of their technical roadmaps and to understand where these organizations encounter challenges and opportunities working with or collaborating on technical standards.

There are many definitions of standards[3] and no uniform "standard for standards development."[4]

Organizations may develop standards independently through multi-party agreements, industry consortia, trade associations, or formal standards development organizations (SDOs). The variety of standards development models leads to a spectrum of approaches. This study does not examine standards and specifications based on the legal structure under which they were created. Instead, it investigates how the characteristics of the standard influence decision-making and perceived value. In particular, this study focuses on the spectrum of characteristics relating to open standards, where, again, no single definition of "open standard" exists. As Sutor[5] suggests, the "openness" of a standard should be viewed as a scale rather than a binary condition, reflecting qualities related to how the standard is created, how it is maintained, what costs are involved, restrictions on the implementation of the standard, and compliance requirements. Similarly, Krechmer[6] identified 10 key factors for developing open standards and recommended that SDOs maintain and publish a listing of how they address each factor. The nature of the technical needs, business requirements of those participating in its development, and other factors influence where the standard might land on a spectrum of openness. Across SDOs, one can observe a variety of approaches that combine open and closed characteristics—there can be as many approaches to standards as there are organizations that develop them. Standards may be developed to support a single company's proprietary ecosystem. Other standards are built on a need for trust and use transparency and public access to support their advancement. There are also many approaches that leverage both open and closed characteristics to exemplify the needs of the ecosystem developing a standard. Many organizations developing open standards may need to restrict participation by limiting contributions to members who are willing to make a royalty-free (RF) intellectual property (IP) commitment. Common characteristics that distinguish an SDO along a spectrum of openness are shown in x and include the following:

- **Intent:** What is the business intent of the standard?
- **Access:** Who will get access to the standard?

- **IP:** What are the copyright and patent terms for contributors and implementers of the standard?
- **Participation:** Who can participate in the development of the standard and how?

Traditional definitions of open standards generally emphasize that the resulting documents were developed using collaborative, non-dominant, balanced, and consensus-based processes that expose changes to open review and comment by anyone willing to participate. Common definitions focus on factors such as openness to all, transparency of the process, and access to patent claims necessary for implementation ("Necessary Claims") on reasonable and non-discriminatory (RAND) terms that imply that anyone can participate in, obtain a free copy of, and implement the standard without a need to pay royalties or other fees.

The characteristics of open standards we've outlined above are also shared by open source software communities, which have grown exponentially and have influenced perspectives on openness in standards development. A few decades ago, it was unheard of for a company to allow others access to its IP portfolio. Today, sharing software is a common activity that allows new

TABLE 1

THE SPECTRUM OF STANDARDS DEVELOPMENT

Approaches vary along a continuum of characteristics

Closed standards ⟷ Open standards

INTENT	Support X company's commercial ecosystem	Exchange access to IP for something of value	Support a frictionless, open, global ecosystem
ACCESS	Anyone who agrees to X's commercial terms	Accessible by any org who agrees to membership terms (maybe even a fee)	Freely, publicly accessible to anyone
IP	Must agree to X's IP licensing terms	Members make IP available to implementers under RAND terms	Participants make IP available to all implementers, under RAND-RF or open license terms
PARTICIPATION	Partner feedback programs	Members only	Anyone

commercial ecosystems to flourish in the face of equally fierce market competition. No agreements need to be signed in order to use open source software as defined by the OSI.[7] However, to produce open source software, many communities require RF access to IP. Without this reciprocal arrangement, access to the open source software commons would be at risk. Therefore, many open source software communities look for standards that allow open source software implementations, and communities such as Open Innovation Network[8] have formed to further protect open source communities from patent aggressors. From the perspective of most open source software communities, "An open standard is a standard that is freely available for adoption, implementation and updates."[9]

The Linux Foundation is perhaps best known for its work in open source and for supporting its flagship project community, the Linux kernel. The Linux Foundation was formed out of a merger of the Free Standards Group with Open Source Development Labs, a combination of standards and open source efforts. Our 20+ years of contributions to standardization efforts are less well-known, but no less impactful. Nearly 20% of Linux Foundation projects are related to standards and specifications, and those projects range in size, complexity, development style, and IP mode.[10] They cut across industry, geography, and target market and have engaged thousands of contributors, organizations, and end users. This history has led us to develop our own, unique perspective on information and computing technology standardization based on principles of openness, developer-friendly tooling, straightforward IP rights (IPR) policies, and flexible working modes. Conversely, we also see many standards development projects that want to build an open source software implementation to help facilitate faster, easier adoption of the standard.

With this background, we are excited to share the first-ever State of Open Standards report, which features insights from global standards participants from a variety of organizations. Our research asked participants questions about the spectrum of standards characteristics. We explored whether standards professionals feel that "open" means RF access to necessarily infringed IP. We explored where organizations derive value from standards. We explored what real and perceived benefits organizations receive in exchange for participating and engaging in standards. Finally, we explored the challenges to participating in standards development and to what extent organizational involvement in standards is connected to open source.

The survey behind this report approached the subject of standards in a simplistic way. This survey, while useful in evaluating alignment with the open and closed endpoint in the standards continuum, did not examine the nature of this continuum with nuance. Although the survey results in this report are effective at highlighting the polarization that exists in open and closed standards, it is important to recognize that they do not capture the different ways that open and closed standards are influenced by each other across the standards continuum. Linux Foundation Research understands that follow-on research that provides a more nuanced view of standards is necessary. Nevertheless, this survey effectively communicates the seismic change that open standards are creating in the standards continuum.

Key findings from this survey are as follows:

- Open standards continue to offer strategic value for organizations: 76% of organizations say that open standards will make them more innovative.
- Open standards are preferred by 71% of organizations compared with restrictive standards (only 10%).
- The top characteristics of an open standard shared by participants from all regions are being openly published and available RF for implementers.
- Open standards encourage competition: 80% of organizations say open standards will make them more competitive.

- Organizations report that accelerating market reliance on standards is eight times more likely to happen with open standards than with standards that have implementation fees.

These findings tell us that companies are leveraging open standards to build more innovative products and increase their ability to compete in the marketplace. A common, open, and RF collaboration approach to fostering innovation is a well-known pattern in the information and communication technology industry that is expanding into other industries. We have also seen an increase in open standards where more restrictive standards development processes have failed to scale with the collaboration needed to add value, such as in the motion picture, energy, automotive, telecommunications, and manufacturing industries. Not coincidentally, these shifts toward open standards often mirror the adoption of open source within an industry. As new technologies enable new digital processes, we often see open source software forming a bedrock of software stacks that companies build their innovation around. In those situations, there is a strong complementary alignment between open source software and open standards. Conversely, standards toward the closed (or restrictive) end of the spectrum tend to struggle in the context of open source software. IP licensing models that frustrate the development of an open source implementation coupled with other restrictions, such as no or limited access to the standard, the confidentiality of discussions and feedback, or other barriers to participation, generally conflict with open source software development models.

We hope you are able to use this report to familiarize yourself with how open standards are perceived by many organizations and to better understand the opportunities and benefits that may arise through engagement with standardization projects. We encourage you to further explore the study data and share your findings with us.

Research overview

We conducted a worldwide online survey to collect insights about organizational involvement in standards, the values and benefits of standards, the trends of standardization, and the barriers to developing and adopting standards. The survey was fielded in January 2023, and we received 496 valid responses, which are the basis for the analysis presented in this report. The survey included questions in the following areas: Demographics, organizational involvement in standards, the value of standards, growth of standards, and the development of open standards. For more information about this research approach and participants' demographics, see the Methodology section of this report.

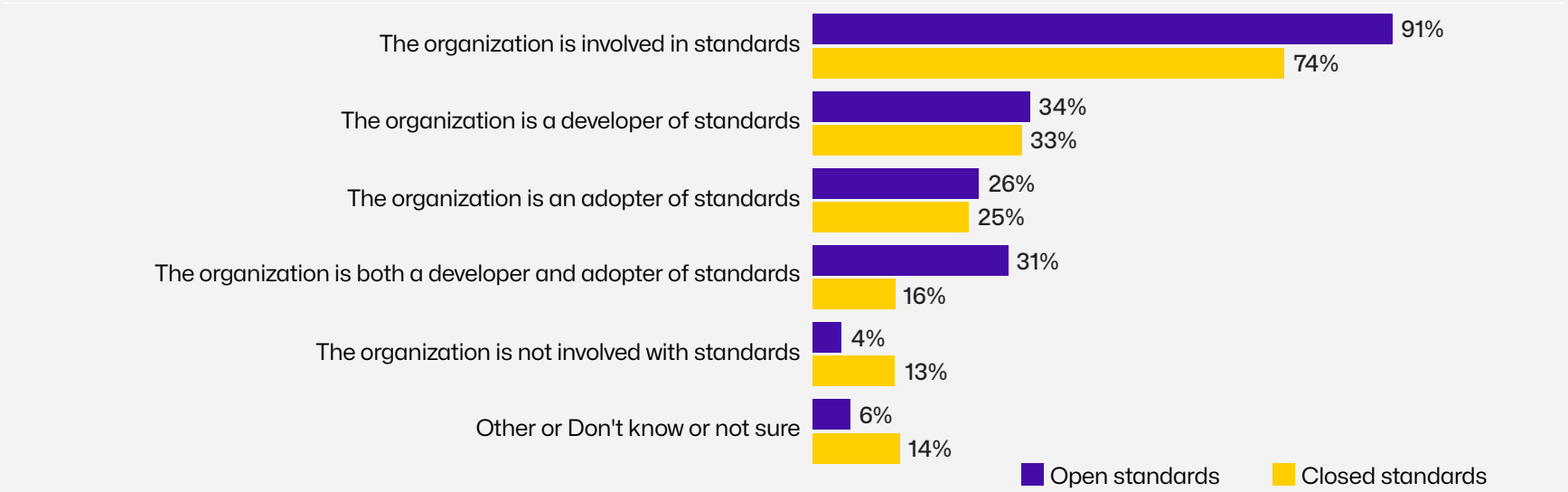
Standards are a critical dimension of how organizations leverage information technology

Some SDOs have noted a decline in new standards development activities in recent years, as measured by the formation of new technical committees or working groups and the publication of new specifications. Indeed, many of our respondents reported that their organizations are not currently members of any SDO. At the same time, interest in and demand for open standards among survey respondents are very high (**FIGURE 1** shows that 91% of surveyed organizations report involvement with open standards). This declining participation in traditional SDOs, coupled with strong growth in open source software investment[11] and strong demand for open standards, demonstrates how organizational technology strategies have changed over time. The value of standardization hasn't changed for an organization, but the organization's preferred methods of engagement with standards have.

FIGURE 1

OPEN STANDARDS DELIVER HIGHER LEVELS OF ORGANIZATIONAL INVOLVEMENT

What is your organization's involvement with open or closed standards? (select all that apply)



2023 STATE OF OPEN STANDARDS SURVEY, Q13, DERIVED DATA, DEVELOPMENT AND ADOPTION OF OPEN STANDARDS, SAMPLE SIZE = 496, VALID CASES = 496, TOTAL MENTIONS = 743.
2023 STATE OF OPEN STANDARDS SURVEY, Q14, DERIVED DATA, DEVELOPMENT AND ADOPTION OF CLOSED STANDARDS, SAMPLE SIZE = 496, VALID CASES = 496, TOTAL MENTIONS = 630.

Our findings reinforce that implementing or co-developing a standard is a key strategic decision in an organization's product or IT roadmap. Contrasting the high degree of reported involvement with lower rates of reported membership in standards organizations[12] furthers the evidence that open standards drive strategic benefits on the basis of their characteristics. If one considers that "involvement" with standards is a proxy for the organizational investment of time and money allocation, R&D, evaluation, and implementation, the importance of standards to the organization's overall technology strategy is irrefutable.

Of the organizations surveyed, 91% are involved with open standards, and 74% reported involvement with restrictive standards (those that do not meet traditional definitions and are royalty-bearing). While participation in standards remains high across the board, our findings show that organizations widely prefer open standards regardless of type, region, size, role, or involvement with standards. The disparity in preference indicates that organizations have deep experience engaging with standards and have developed stronger preferences based on the outcome of those experiences. When asked why an organization should become involved with open standards, respondents emphasize security and quality improvements, further supporting the argument that these preferences are based on realized, rather than idealized, characteristics and results.

Interestingly, the characteristics deemed necessary for an open standard vary somewhat by geographic region and reflect regional differences in market development, public policy, and consumer behavior. Despite this variation, the top characteristics of an open standard—being openly published and available RF for implementers—were highly identifiable characteristics, regardless of region. This indicates that the availability of a standard is the key identifying factor of an open standard and that the organization's ability to access standards greatly influences decision-making.

An organization's ability to shape and influence the standards it builds on can greatly impact how well it recaptures value in its technology stack. Open standards are seen as far easier to participate in than restrictive standards, with some interesting variance reported in small and very large organizations. We explore this further in our key findings below.

Involvement with standards is widespread

Standards are popular among organizations. **FIGURE 1** shows that 91% of organizations are involved with open standards and 74% with restrictive standards. The high levels of involvement with standards demonstrate that organizations recognize the benefits of standards, such as ensuring that products and services are compatible, interoperable, and policy-compliant. This high level of involvement also refutes arguments that open source has supplanted or replaced the benefits of standards development within an organization.

We also observe in **FIGURE 1** that open standards are more accessible to organizations: 65% of the organizations surveyed are involved in developing open standards, compared with 49% of the organizations involved in developing restrictive standards. The number of organizations not involved with restrictive standards (13%) is three times higher than those that reported no involvement with open standards (4%). Further, the number of organizations reporting involvement in both developing and adopting standards was twice as high for those participating in open (31%) compared with restrictive (16%) standards. This indicates that organizations developing and adopting open standards may be reaping additional benefits and generating positive externalities in the marketplace. These observations support the ease in developing open standards and highlight the predominance of open standards engagement as part of organizational strategy.

Organizations widely prefer open standards

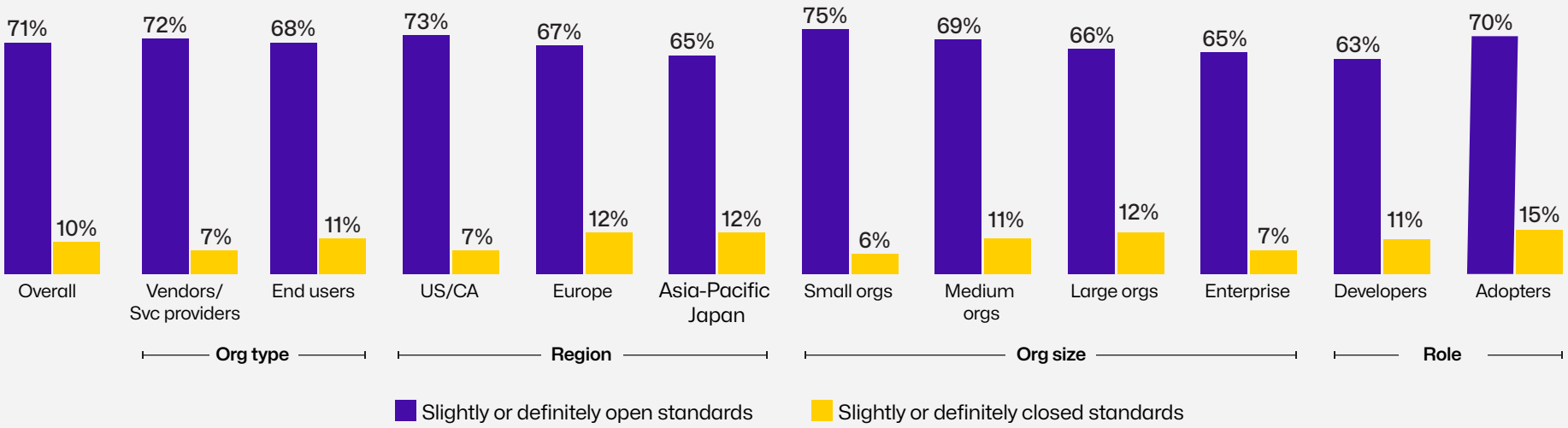
There has been a noticeable increase in open standards in recent years.[13] Our study confirms this trend, with **FIGURE 2** showing that 71% of organizations overall prefer open standards in contrast with restrictive standards, which are preferred by 10% of respondents. We surmise that this minority preference reflects some percentage of respondents who are vendors with Necessary Claims or hold other rights they feel grant a market advantage.

Even though organizations of all sizes clearly prefer open standards, small organizations show the strongest preference for open standards (75%), compared with only 6% of small organizations preferring restrictive standards. Adopting and developing non-open standards may require capital or specialized resources, access to information and support, the ability to influence, and a capacity to participate, which is costly to smaller organizations with constrained resources. The cost of adoption can also create additional barriers to the participation of smaller organizations in the market—in addition to the cost of implementing a standard into a product or service, royalty-bearing standards come with licensing, legal, or other fees that need to be absorbed or passed on to customers. As a result, open standards are often seen as a more accessible and economical option for smaller organizations. From a

FIGURE 2

PREFERENCE FOR OPEN STANDARDS PREVAILS ACROSS ORGANIZATION TYPES, GEOGRAPHIES, ORGANIZATIONAL SIZES, AND ROLES

Comparing the models for standards development (open vs. closed), which model does your organization prefer? (select one)



2023 STATE OF OPEN STANDARDS SURVEY, SELECTED RESPONSES, OVERALL (TABLE A35), BY ORGANIZATION TYPE (TABLE A36), BY REGION (TABLE A37), BY COMPANY SIZE (TABLE A38), BY ROLE (TABLE A39), SAMPLE SIZE = 377 TO 421.

The value of standardization hasn't changed for an organization, but the organization's preferred methods of engagement with standards have.

competitive standpoint, open standards "level the playing field" for organizations of all sizes. This point is revisited in **FIGURE 4**.

Geographically, although all regions clearly show a preference for open standards, North America (mostly represented by the U.S. and Canada in our survey) stands out, with 73% of organizations indicating a preference for this model. Only 7% of organizations in North America show a preference for restrictive standards, while 12% of respondents from Europe and Asia-Pacific prefer that model. This finding is notable because of the political and economic differences between the regions analyzed. Standards development in North America is highly influenced by the U.S.'s innovation-based tech economy and market-led regulation, compared with the state-controlled economies of the Asia-Pacific Japan (APJ) region and government-led regulations of the E.U. Indeed, each of these regions has distinct standardization philosophies, and it is remarkable that open standards are the strong preference despite these differences.

FIGURE 2 also shows that open standards are largely preferred even when segregated by organization type and role. We observe that open standards were the overwhelming preference across all segmentations. Clearly, open standards play an important, strategic role in an organization's technology strategy, regardless of demographic differences—democratizing access for smaller organizations with fewer resources to spare, access to different geographic and commercial markets, and access to develop or adopt technology regardless of the industry or business model of the organization. This helps encourage market competition and other economic benefits, which we explore later when discussing how open standards increase competitiveness and innovation.

With the continued growth and adoption of open standards, we can expect to see even greater levels of involvement from a variety of organizations in the future.

The importance of open standards attributes varies by geographic region

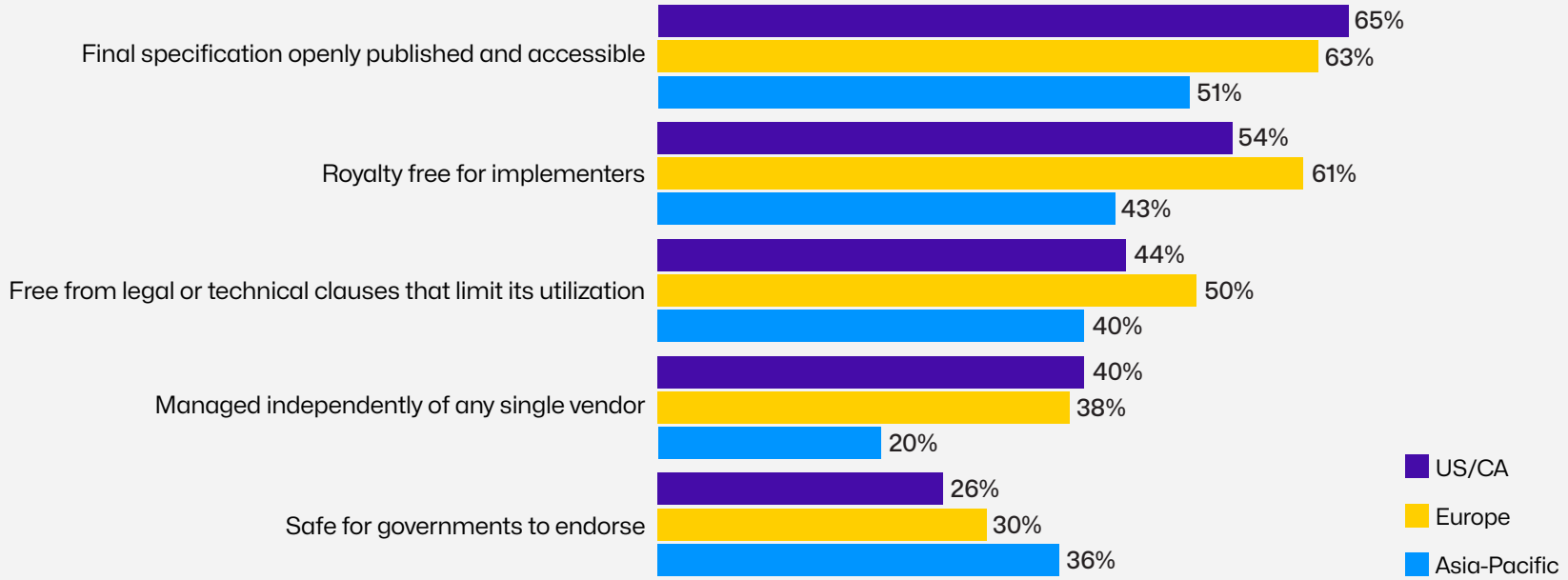
Global engagement in open standards is driven by a desire for greater collaboration, interoperability, and access to innovation. However, there are regional differences in priorities and preferences. Understanding these regional differences is an important part of developing effective and widely adopted open standards that can benefit organizations and industries worldwide.

As shown in **FIGURE 3**, one key difference we found is the E.U.'s strong agreement that an open standard must be royalty free (RF) for implementers—this position was held by 61% of respondents from Europe, compared with 54% of North American respondents and 43% of those from APJ. Royalty free refers to a license model where the rights holders agree to license the patents necessary to implement the technology or standard without paying royalties or other licensing fees. Royalties and patent licenses are seen as a way for organizations to recoup investment costs in developing new technologies and are argued to provide incentives for innovation. In practice, however, this approach can reduce innovation in the market when these fees are cost-prohibitive to new entrants and viable alternatives to the incumbent, royalty-bearing standards are not available. Therefore, RF essential patent licensing standard options are seen as an important way to ensure competitive, democratic access to innovation, greatly reducing the risk of an organization monopolizing the market or controlling access to important market technology.

FIGURE 3

CHARACTERISTICS OF OPEN STANDARDS SEGMENTED BY GEOGRAPHIC REGION

Which characteristics do you believe are necessary for a standard to be an open standard? (select all that apply) segmented by organization region



2023 STATE OF OPEN STANDARDS SURVEY, SELECTED RESPONSES, Q20 (TABLE A16) X Q7 (TABLE A7), SAMPLE SIZE = 425, VALID CASES = 425, TOTAL MENTIONS = 1,875.

The survey results also highlight regional contrasts that reflect differences in policy and market behavior. Europe placed more emphasis (50%) on considering that an open standard should be "free from legal/technical clauses that limit its utilization" than respondents from North America (44%) and APJ (40%). This finding aligns with Europe's philosophical approach to competition laws, which emphasize requirements for fairness and equitability among market competitors. It may also reflect a response to the market dominance of American companies in new technology sectors. By comparison, competition laws in the U.S. emphasize a "free enterprise" philosophy and consumer protections, while APJ economies, such as China and Japan, feature more government-sanctioned market monopolies. APJ's greater emphasis (36%) on being "safe for government to endorse" and its greater level of comfort (20%) with an open standard being managed by a single vendor bolster the argument that the valuable characteristics of an open standard vary regionally and reflect national economic policy—these numbers are 26% and 40% for North America and 30% and 38% for Europe, respectively.

Nevertheless, the requirement that an open standard should be "openly published and accessible" was shared across regions. The availability of a final specification that can be reviewed and evaluated without obstacles—e.g., fees to discover, access, or download specifications—generates opportunities for greater collaboration and innovation and an increased number of implementations of the technology, encouraging new use cases, applications, and constructive feedback.

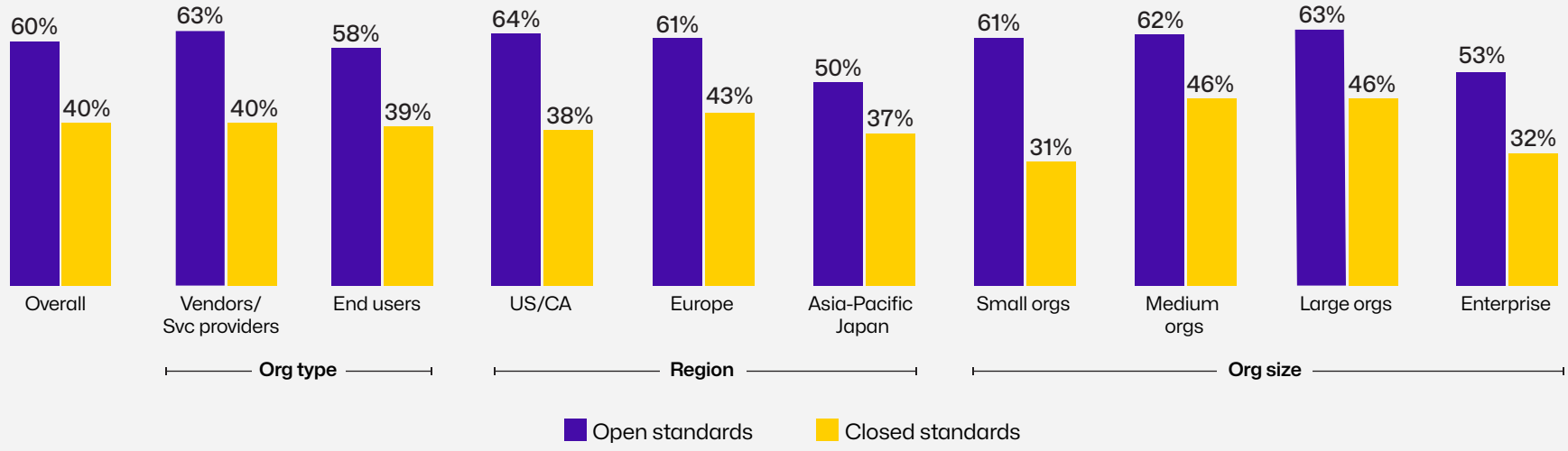
Open standards excel in their ease of development

In **FIGURE 1**, we observed that involvement in standards, particularly open standards, is widespread. One reason is that open standards may be easier to develop. Indeed, **FIGURE 4** shows that across the survey, 60% of organizations reported that participation in open standards development is easy, compared with 40% that consider restrictive standards easy to develop. This is a statistically significant gap, reflected across regions, organization size, and organization type.

FIGURE 4

EASE OF PARTICIPATION IN THE DEVELOPMENT OF OPEN STANDARDS ACROSS ORGANIZATION TYPES, GEOGRAPHIES, AND SIZES

How easy is it to participate in the development of a standard? (percentage selecting somewhat easy or very easy)



2023 STATE OF OPEN STANDARDS SURVEY, SELECTED RESPONSES, OVERALL (TABLE A52), BY ORGANIZATION TYPE (TABLES A53/A54), BY REGION (TABLES A55/A56), BY COMPANY SIZE (TABLES A57/A58), SAMPLE SIZE = 364 TO 406, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

The difference is most profound for small organizations, which are less likely to have additional or specialized resources to participate in a restrictive standard project. Indeed, there is more variability across organization size than other segmentations, indicating that the challenges of participation in a restrictive standard are a strong limitation for certain organizations. Open standards are perceived as leveling the playing field in a way that allows smaller firms to collaborate and compete with larger, well-resourced firms.

Additional observations support our earlier findings about characteristics and preferences. The difference in ease of participation between open and restrictive standards is the smallest for organizations in the APJ region, reflecting that region's comparative comfort with government-led market regulation. Enterprise organizations reported the lowest levels of overall ease in participation, which may reflect factors such as the complexity of their organizational structure, legal and internal policy constraints, size-based market regulations, or more elaborate product and technology strategies to manage.

Comparing the findings highlighted in **FIGURE 2**, preference for open standards, with those of **FIGURE 4**, ease of participation, one might expect the charts to illustrate similar variation. The levels of preference are strikingly high, while ease of participation is less stark by comparison, indicating that the organizations accept any challenges to participation in standards development as a "cost of doing business" and likely do little, if anything, to impact preference for open standards. The preference metrics in **FIGURE 2** reflect additional perceived benefits to participating in open standards development beyond ease of participation, which we explore in later key findings.

Open standards have eclipsed restrictive standards in driving value, competition, and innovation

Previous research has tackled the impact of open source and open standards development from an economic perspective.[14] [15] [16] While the findings of these studies give us the data to support economic arguments for openly developed technologies, our study provides additional insight into how organizations perceive the benefits of open standards. Respondents to our study strongly agreed that open standards provide a real return on investment (ROI), drive innovation and marketplace competitiveness, and offer benefits such as improved quality, security, and firm reputation. Many respondents also reported that while their organizations participate in patent licensing as part of their business activities, the benefits of open standards outweigh the benefits of licensing royalties.

In this study, we sought to learn more about how organizations incorporate standards into their technical and business strategies to capitalize on their benefits. We asked about benefits, reasons for choosing an open standard strategy, competitive and innovative advantages of the two standardization models, and how the value derived from open standards is changing over time.

We observed that organizations across the globe see value in standards, with the different approaches offering distinct opportunities depending on the specific needs and goals of the organization. While open standards are widely acknowledged for their ability to drive innovation and meet customer preferences, patent royalties still hold value for certain organizations. Nevertheless, most organizations—even those that rely on patents as a revenue source—prefer open standards and agree that their customers prefer to use products and services based on open standards.

Open standards have become a powerful driver of industry value, market-wide innovation, and competition. They have been instrumental in accelerating the adoption of new technologies, promoting innovation in various sectors, and enabling businesses to address market needs in a timely manner. As more organizations embrace open standards, the industry will continue to reap the benefits of increased innovation, better products and services, and a more competitive landscape. We examine the attitudes and key trends driving this change in the key findings below.

Open standards consistently provide more organizational benefits

Economic value is fostered when the marketplace has the right balance of competition to ensure a variety of available options to the consumer and a fair price, innovative products or services to ensure appropriate quality or feature differentiation for the consumer, and responsiveness to changing needs and demands to ensure efficiency to the resulting products and services. **FIGURE 5** illustrates that open standards are viewed as far more effective at driving economic value. This finding provides a strong rationale for the overwhelming preference for open standards across organization sizes, types, regions, and industries.

FIGURE 5 shows that 73% of organizations believe that open standards better accelerate the adoption of a technology within the market, compared with only 9% who reported better acceleration from restrictive standards. Given the necessary characteristics of an open standard as identified in **FIGURE 3**, this isn't wholly surprising—the publicly accessible nature of an open standard makes it better suited to drive widespread adoption because it is easier to access, distribute, and evaluate.

Widespread adoption of a standard is indicative that the standard is efficient at addressing market needs and providing value to

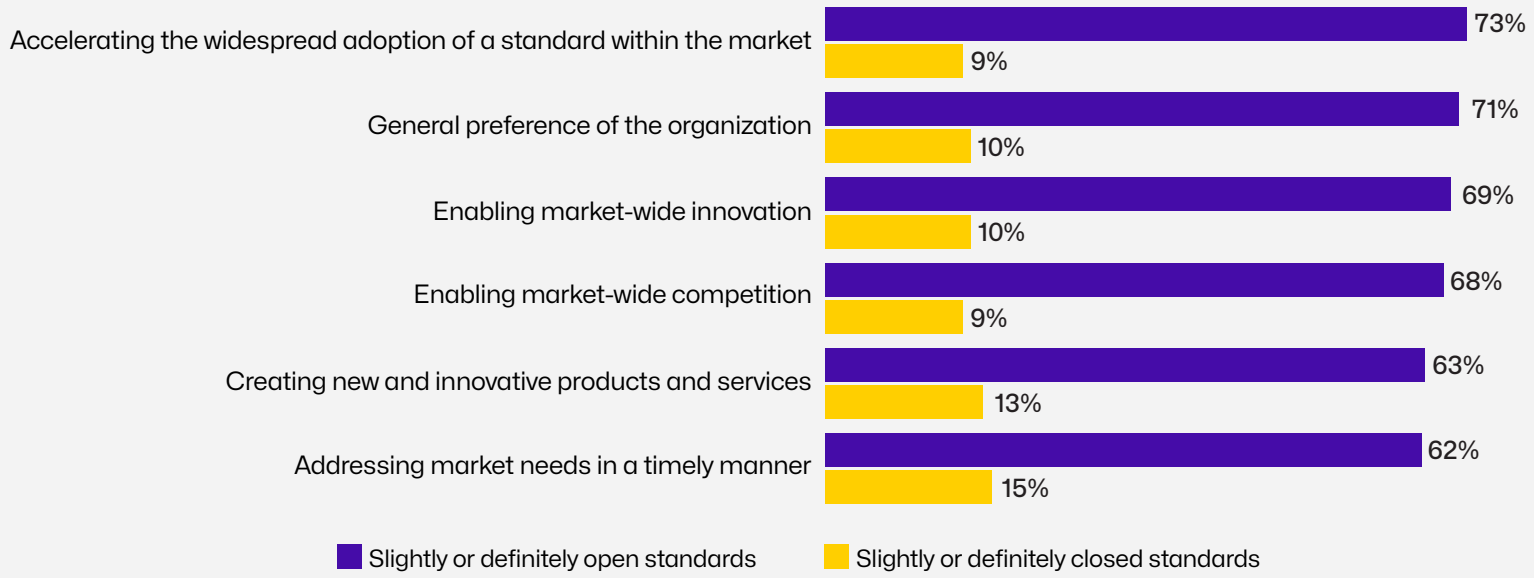
consumers and competitive benefits to organizations. **FIGURE 5** also shows that open standards are better suited by a wide margin across market needs. Respondents reported that open standards are better equipped for enabling market-wide innovation and competition, creating new and innovative products and services, and addressing market needs in a timely manner.

Examining these responses by organization size offers an additional perspective. Appendix Table A28 shows that 94% of enterprise-sized organizations believe that open standards enable market-wide innovation and competition, which is notably higher than the unsegmented response rate (68% and 67%, respectively as shown in Table A27). This variation by organization size likely indicates the larger firms' ability to capitalize on an open standard, leveraging their market size and position, greater resources, and other growth and scale variables to take full advantage of the standard's benefits.

FIGURE 5

OPEN STANDARDS ARE VIEWED AS FAR MORE EFFECTIVE THAN RESTRICTIVE STANDARDS AT DRIVING INDUSTRY VALUE

For the following activities, which type of standard (open vs. closed) better supports implementing these activities? (percentage selecting definitely or slightly)



2023 STATE OF OPEN STANDARDS SURVEY, SELECTED RESPONSES Q28 (TABLE A27), Q33 (TABLE A33), Q34 (TABLE A34), SAMPLE SIZE = 421-422, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

Small and medium-sized organizations also report a greater preference for open standards when it comes to enabling market competition and innovation—again, this may indicate that the combination of the organization's unique position, coupled with the characteristics of open standards, drives this market value.

When organizations were asked what model they generally prefer for standards development, Appendix Table A28 shows that 76% of small organizations prefer open standards. This number is 70% for medium-sized organizations, 66% for large organizations, and 65% for enterprise-level organizations. This strong preference for open standards reflects the ability to empower businesses, regardless of size, with the tools and resources to compete and innovate in the market.

Open standards increase competitiveness and innovation

As previously noted, bringing technologies and solutions to the marketplace in a timely manner drives overall economic value and creates competitive advantages for the contributing organizations. Timing novel solutions with market needs and demand is a complex objective for which open standards provide compelling strategies. And, like compound interest rates, early competitive benefits have a way of building and accelerating over time. We also explore this later in **FIGURE 11**.

Reinforcing our previous findings that open standards are the preferred development method for market competition and innovation benefits, we additionally find that open standards are perceived as strongly facilitating organizational competitiveness and innovation over time. **FIGURE 6** shows that a significant 76% of organizations report that open standards increase competitiveness in the short run, rising to 79% in the long run. Similarly, the impact of open standards on innovation is evident: 79% of organizations report that open standards increase innovation in the short run, with this number increasing to 81% in the long run.

The publicly accessible and RF characteristics of an open standard allow multiple vendors to implement a technology, create compatible or interoperable solutions, build new features, improve quality, or provide other value to consumers and end users. Consumers, in turn, benefit from having these interoperable solutions and choices. At the same time, the market benefits from positive externalities such as reducing the barrier to entry for new players in the market and keeping prices fair. The market decides which technologies are the most viable, and competition leads vendors to innovate more quickly.

Moreover, the processes adopted to develop open standards have shown to be a sustainable approach to technology development in the long run. Many "legacy" open standards are still in active use and maintenance decades later. By contrast, non-open processes may exacerbate maintenance challenges as access to key information, decision criteria, justifications, and persons with first-hand knowledge becomes more restricted over time.

Standards continue to factor into organizational IP strategy

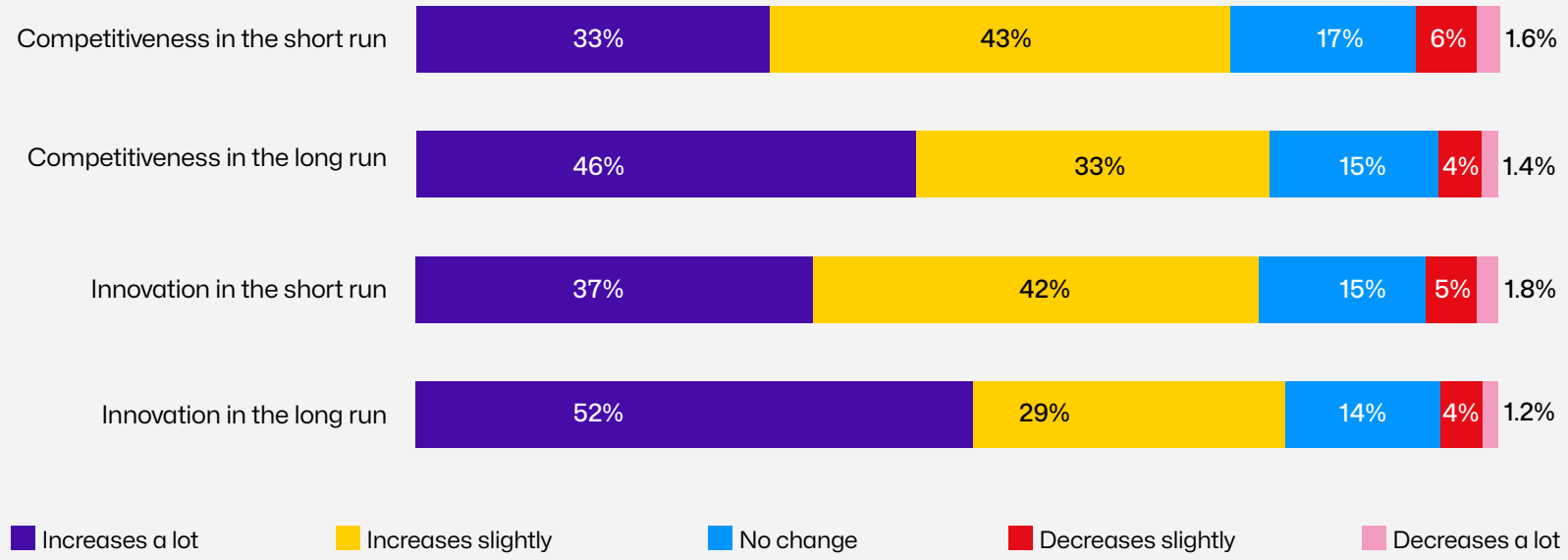
Patent portfolios reflect the collection of novel IP developed by an organization and remain a significant source of value and opportunity, particularly for organizations with the resources to manage their portfolios effectively. A patent gives its owner the legal right to exclude others from making, using, selling, or importing an invention for a limited time in exchange for publishing a disclosure of the invention. The legal theory for this approach imagines that along with creation, public disclosure of the invention provides societal benefits, while the rights protections afforded incentivize companies to invest in R&D by allowing them to profit through royalties, licensing agreements, and other fees from their discoveries.

Standards-essential patents (SEPs) are commonly defined in the IP policy, under which a standard is developed. SEPs refer to a patented invention that is necessary to implement a technical

FIGURE 6

THE IMPACT OF OPEN STANDARDS ON COMPETITION AND INNOVATION

How do open standards impact competitive solution availability and market innovation? (select one response per row)



2023 STATE OF OPEN STANDARDS SURVEY, SELECTED RESPONSES Q22 (TABLE A18), Q23 (TABLE 19), SAMPLE SIZE = 442, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

standard. When developing a standard, the IP policy for that development effort will commonly state how SEPs will be licensed. Standards IP policies often require patent owners to offer a license to their patents that are SEPs under a RAND model to implementers of a standard. These RAND licenses often require a payment to the SEP owner but can also be licensed "royalty-free" (RAND-RF).

We do not test the theory of whether exclusive rights for patenting inventions properly reward R&D investments in our study. However, it is notable that despite the theoretical benefits, our survey found that 73% of organizations agree that the advantages of open standards explicitly outweigh the patent royalty opportunities, compared with just 8% that disagree (**FIGURE 7**). Additionally, 72% of organizations agree that their customers prefer to use products and services based on open standards, with only 8% disagreeing. This finding supports both 1) there is a strategic value of patents to organizations, and 2) the strategic value to organizations is often not the monetary value that might be recouped through royalty opportunities.

Still, as illustrated in **FIGURE 7**, organizations generally report that patent royalties derived from standards provide a good ROI (58%

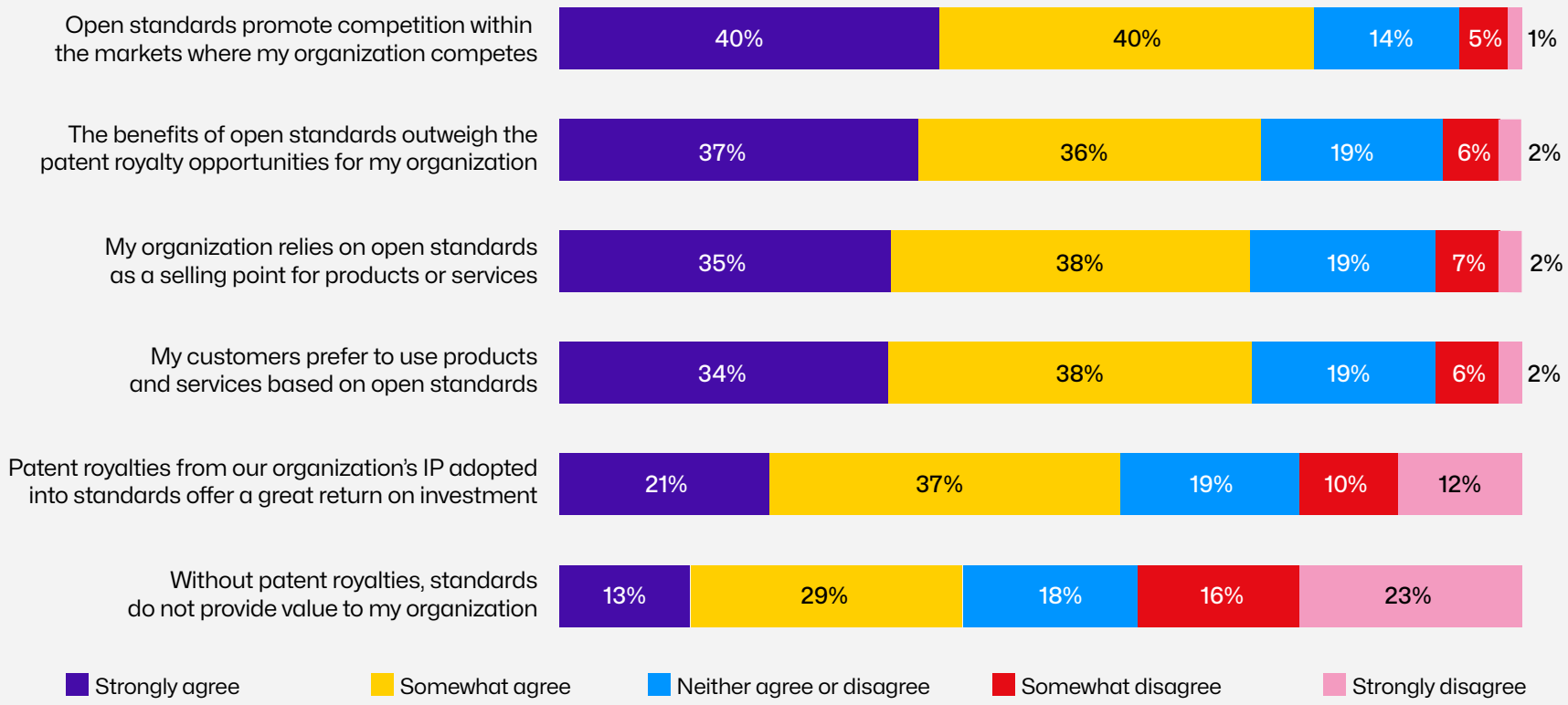
agree). Interestingly, the survey also revealed a split decision on the value of restrictive standards and their patent royalties. While 39% of organizations disagree that standards without patent royalties provide value, 42% agree with this notion. This suggests that both royalty-bearing and RAND-RF standards hold value for different organizations, depending on their market strategy and previous experiences. It also suggests that organizations are intentional about when they engage in standards and the licensing model for the outcome they desire in a standard. Sometimes, the market opportunity created from having an open standard outweighs the value of any SEP opportunity.

Appendix Table A30 offers an interesting example of this dynamic. The Asia-Pacific region is highly invested in patent royalties, with

FIGURE 7

RAND AND RAND-RF STANDARDS BOTH FACTOR INTO ORGANIZATIONAL STRATEGIES

How much do you agree or disagree with the following statements? (select one response per row)



2023 STATE OF OPEN STANDARDS SURVEY, Q29 (TABLE A29), ORIGINAL SAMPLE SIZE = 422, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

53% of organizations focused on this approach, compared with 38% in North America and Europe. Furthermore, 73% of organizations in the Asia-Pacific region report that patent royalties provide a great ROI compared with North America (52%) and Europe (42%). Despite this strong focus on patent royalties, the Asia-Pacific region also recognizes the benefits of open standards. A notable 77% of organizations in this region state that the benefits of open standards outweigh patent royalty opportunities compared with North America (71%) and Europe (67%).

We also found that medium-sized and large organizations are the most focused on leveraging patents and royalties, as shown in Appendix Table A31. This might be because these organizations have more resources to invest in patenting and may be better positioned to negotiate licensing agreements, giving them a competitive edge in the market.

Organizations primarily derive value from products and services built around standards

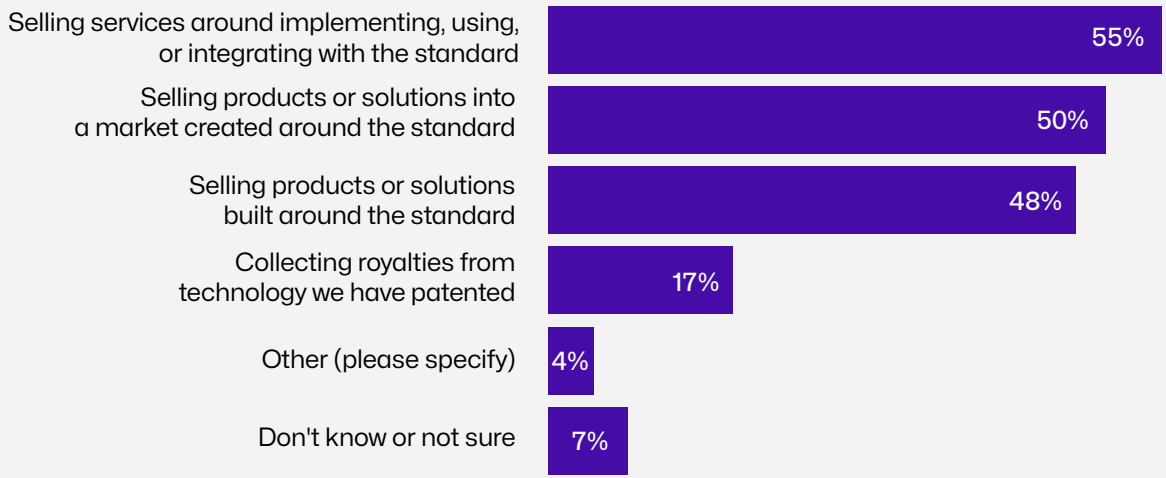
Organizations derive value from standards in multiple ways. As shown in **FIGURE 8**, royalties are important to only 17% of organizations responding to our study. Far more organizations reported that they derive value from standards in other ways, e.g., by focusing on services, usage, or integration with standards (55%); selling products into a market created by the standard (50%); or selling products built to the standard (46%). This clearly supports the previous finding that standards are critical to an organization's overall technology and IP strategies.

The collection of royalties as a business activity varies across regions. Appendix Table A21 shows that organizations in the Asia-Pacific region (21%) and North America (19%) are more likely to focus on collecting royalties, while European organizations (7%) seldom engage in this practice. This regional disparity

FIGURE 8

ORGANIZATIONS PRIMARILY DERIVE VALUE FROM STANDARDS THROUGH PRODUCTS AND SERVICES

How does your organization generally derive value from standards? (select all that apply)



2023 STATE OF OPEN STANDARDS SURVEY, Q24 (TABLE A20),
SAMPLE SIZE = 442, VALID CASES = 442, TOTAL MENTIONS = 800.

demonstrates the different market approaches and priorities that exist within the global technology landscape and supports our previous observation that the importance of different attributes of open standards varies by region.

Regardless of the region or type of organization, organizations derive value from standards in one or more ways. In order to maximize that value, organizations should carefully assess the benefits and limitations of standards and take proactive steps to identify the most suitable approach for their specific needs and market objectives.

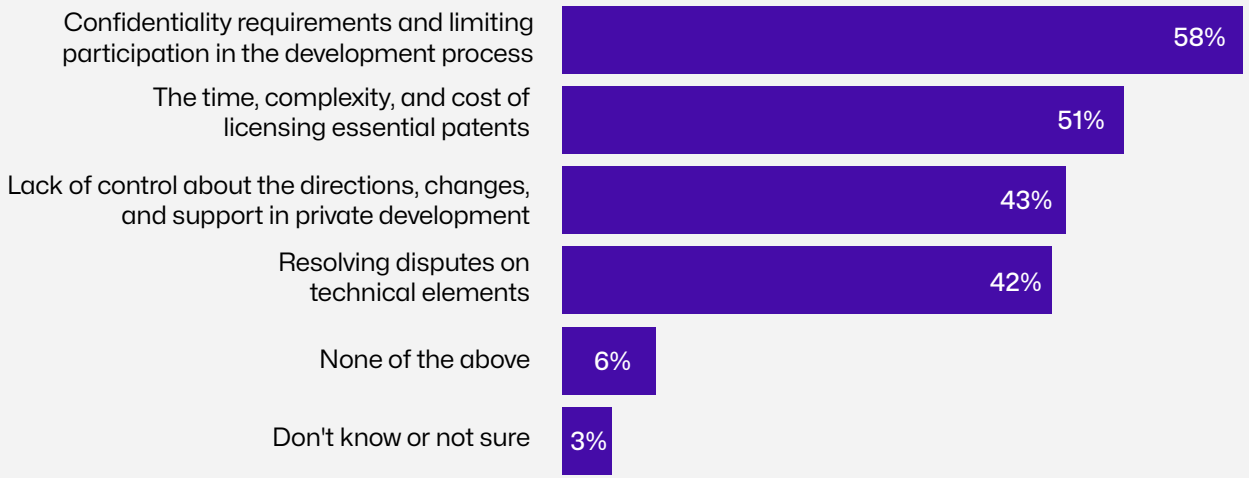
There are a number of challenges in developing a standard

All standards development efforts face challenges at some point in their formation, advancement, or implementation. Challenges related to licensing, management, and control of IPR are common concerns, particularly in RAND projects. Indeed, three of the four challenges in **FIGURE 9** are specifically aligned with characteristics of non-open standards, while the fourth challenge (resolving technical disputes) is common across all standards projects. The necessary characteristics of open standards as identified in our

FIGURE 9

RESTRICTIVE STANDARDS HAVE SIGNIFICANT BARRIERS TO ADOPTION

Which of the following do you consider to be barriers to the widespread adoption of a standard? (select all that apply)



2023 STATE OF OPEN STANDARDS SURVEY, Q32 (TABLE A33), SAMPLE SIZE = 421, VALID CASES = 421, TOTAL MENTIONS = 850.

previous finding—an openly published final specification and RF for implementers—are well suited to mitigating the challenges our respondents identified.

One of the leading challenges to adoption, cited by 58% of organizations in **FIGURE 9**, is the confidentiality requirements that limit participation in the development of a standard. Specifications developed outside an SDO may be subject to multi-party non-disclosure agreements. Although it is rare for participants in SDOs to be required to sign non-disclosure undertakings, many SDOs conduct collaborative activities behind a "member wall" that restricts access to members and select invited participants (the reason is to prevent non-members, who are not bound by the organization's IPR policy, from filing patent claims based on the work in process). Policies related to membership, such as whether there is a membership fee, the extent to which work items can be shared outside the member wall, and public review procedures, are common and vary across SDOs.

Another significant challenge, according to 51% of organizations surveyed, is the time-consuming, complex, and costly process of obtaining, managing, and licensing essential patents. Licensing an essential patent is an involved process that requires precise determination of the innovations being made available to which licensors, for which purpose, and at what price and terms. This usually requires negotiations that can take months or years to determine and introduces cost and complexity to the standard's development that many organizations cannot bear without significant financial and organizational commitment. By comparison, licensing essential patents is far more straightforward under common open standards development modes—the patent holder generally retains their rights to the innovation but grants an RF license to use any essential patent required for implementers. There may be a process for the exclusion of certain patents, but the process is generally simpler under common models for open standards.

Finally, 43% of organizations identified the lack of control over the direction, changes, and support as a significant challenge. This issue may arise because of the perceived challenges in providing input or influence to non-open standards processes. Additionally, information about the development process—e.g., the use cases, requirements, proposed or competing alternatives, and justifications for a preferred approach—may be opaque or member-confidential. This is a significant barrier to adoption because it hinders the evaluation of the standard and puts later participants in the standard at a significant disadvantage. A prime example of this challenge is the Master Quality Authenticated (MQA) standard in the digital audio playback industry. While the standard promises superior sound quality, the techniques used to achieve this result are not publicly disclosed, creating issues for consumers who want to evaluate compatibility, implementation requirements, and other variables. Additionally, the high costs associated with licensing and implementing MQA may further discourage adoption, even though the technology has been shown to be effective.

Open standards persist despite opposition

Despite the widespread preference for and numerous benefits of open standards, non-open, royalty-bearing standards remain pervasive in certain technology spaces, such as video codecs. This area has a notable lack of widely adopted open standards and in most cases has faced sharp resistance to them by the rights holders of incumbent, royalty-bearing standards to protect those revenue streams. For example, the Alliance for Open Media (AOM)[17] is a non-profit industry consortium that develops open standards for multimedia delivery with a focus on streaming use cases that alternative standards have largely ignored. AOM develops the AV1 video codec for transmitting multimedia content over the Internet, which competes with an established High Efficiency Video Coding (HEVC) RAND standard. HEVC rights holders have challenged AV1, attempting

to limit its adoption, reduce choice for consumers, and continue a lock-in for a standard that was not designed for modern streaming use cases.

A silver lining to these challenges is that there is a growing demand for a free and open standard that can be universally adopted and implemented without any financial or legal barriers. **FIGURE 10** shows that when asked if there is a market need for an open standard video streaming codec that is RF for implementers, 86% of organizations said "yes" and 14% said "no." The overwhelming majority of organizations acknowledging the need for such an open standard codec suggests that many businesses and industries are seeking an open standard designed for streaming use cases that may also create a more equitable playing field. This trend reflects a broader shift toward open standards and highlights the increasing importance of accessibility, affordability, and interoperability in today's digital landscape.

FIGURE 10

THERE IS A CLEAR DEMAND FOR AN OPEN STANDARD VIDEO STREAMING CODEC

Is there a market need for an open standard video streaming codec that is royalty-free for implementers? (select one)

2023 STATE OF OPEN STANDARDS SURVEY, Q36 (TABLE A42), SAMPLE SIZE = 421, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

Open standards transform organizations in positive ways

As earlier findings in this study have supported, there are clear preferences for and market benefits to RAND-RF, open standards. Nevertheless, some organizations continue to support royalty-bearing standards for the purposes of protecting proprietary technologies or specialized solutions. The two models drive innovation differently depending on the circumstances of the market or specific industry requirements. They also affect organizations engaging in standards development in vastly different ways—an organization participating in the development of RAND standards may have to spend more of its resources defending a patent position, whereas one developing open standards may be able to spend more of its resources on innovation activities.

Our results also show that open standards have experienced growing adoption across various industries due to their inherent benefits and characteristics. A significant number of organizations in our survey reported an increase in value provided by open standards over the last three years, while only a few experienced a decrease. We also observed a positive correlation between the increased adoption of open standards and increased benefits such as enhanced competitiveness, innovation, and security. These findings also support the earlier observation that open standards provide a generally faster approach for bringing innovations to market, potentially creating competitive advantages as early market successes compound value over time.

In addition to market benefits, organizations can gain strategic, tactical, and indirect advantages by actively participating in developing and implementing open standards. Some of the advantages reported include improved productivity, reduced total cost of ownership, avoidance of vendor lock-in, and increased attractiveness as a workplace. Survey respondents overwhelmingly agreed that their organizations should increase participation in open standards for these reasons.

First-mover advantages can establish a standard approach to a market or industry

Recalling the video codec industry example, RAND-RF standards can face stiff opposition from rights holders engaging in RAND standards development. The video codec space is heavily patent-encumbered, as compression and streaming techniques have high applicability across lucrative channels, such as digital media production and content streaming. While this study does not specifically focus on the video codec industry, we can observe that the earliest standards for video codecs, such as H.261, were developed under RAND policies and more restrictive processes, which generally remain in place today. Open standards, such as AV1, have seen limited adoption thus far as small groups of patent owners vigorously defend their existing business models.

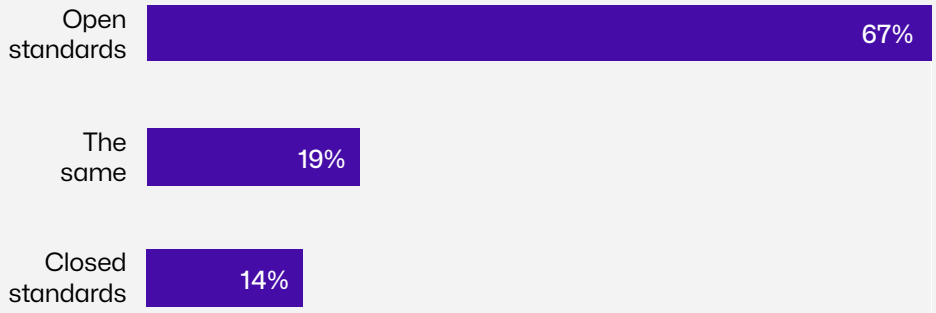
The extent to which the dominant approach to standardization for the video codec industry has stifled innovation may be argued. Our survey asked which approach organizations believe provides the most innovation value in the video codec space, given that market's particular conditions. As illustrated in **FIGURE 11**, the results show a clear preference for open standards, with 67% of organizations believing that open standards are the best way to drive innovation in the standards, such as video streaming codecs. Only 14% of organizations side with RAND standards as the primary driver of innovation. This result is highly correlated with the 14% of respondents who answered "No" in **FIGURE 10**, indicating that a minority still prefer RAND approaches for driving innovation.

Interestingly, 19% of respondents who agreed that there is a marketplace demand for an RF, open video codec in **FIGURE 10** responded in **FIGURE 11** that open and restrictive approaches provide the same amount of innovation value to the video codec

FIGURE 11

INNOVATION THROUGH STANDARDS SUCH AS VIDEO STREAMING CODECS IS BEST ACHIEVED THROUGH OPEN STANDARDS

For standards such as video streaming codecs, which approach will provide the most innovative value to the industry? (select one)



2023 STATE OF OPEN STANDARDS SURVEY, Q35 (TABLE A40), SAMPLE SIZE = 421, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

industry. This highlights the finding that these approaches drive innovation differently, depending on the specific circumstances and requirements of the industry. While, as our study finds, open standards are preferred and provide more overall benefits, RAND standards can offer unique benefits in certain situations, such as when protecting proprietary technologies or focusing on specialized solutions that require significant investment and dedicated expertise. In some cases, a combination of RF and royalty-bearing standards might be necessary to strike a balance between encouraging widespread collaboration and protecting critical IP.

Open standards delivered stable or increasing value over the last three years

Open standards have been gaining traction across various industries as a development and innovation methodology. We hypothesize that this is because the necessary characteristics of open standards—public availability of the final specification and RF for implementers—have consistently delivered competitive benefits, greater innovation, cost savings, and other advantages over time. Our findings greatly support this idea, and **FIGURE 12** shows that 64% of organizations in our survey reported that the value provided by open standards to their organizations has increased over the last three years. In contrast, only 5% of organizations indicate that the value derived from open standards has decreased, and 32% believe that the value remains unchanged.

These findings offer a powerful testimony to the multidimensional value proposition of open standards and the significance of open standards in today's rapidly evolving technological landscape. An overwhelming 95% of organizations state that the value derived from open standards either remains constant (32%) or is increasing (64%), with only a small percentage reporting a decrease in value. We can expect to see greater adoption and development of open standards in the near future.

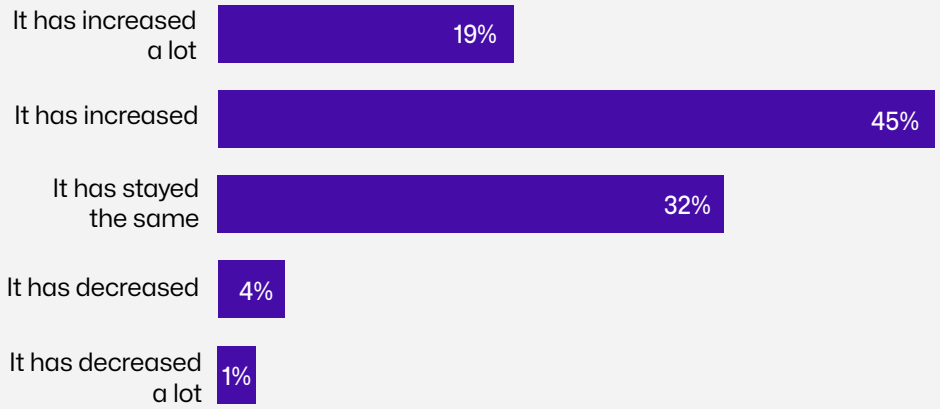
Contributions to open standards provide a variety of hard and soft benefits

Contributing to open standards development brings a plethora of benefits to address business and customer needs. **FIGURE 13** shows that 84% of respondents agree that their organization should contribute to an open standard to improve its overall quality, and 79% feel the same way about security. This reflects the widespread acceptance of "Linus's Law" as a development approach—because open standards are available for everyone to review, implement, and thus find areas of improvement and

FIGURE 12

OPEN STANDARDS VALUE TO ORGANIZATIONS OVER THE LAST THREE YEARS IS ACCELERATING

Over the last 3 years, how has the value that your organization derives from open standards changed? (select one)



2023 STATE OF OPEN STANDARDS SURVEY, Q41 (TABLE A48), ORIGINAL SAMPLE SIZE = 410, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

provide feedback, key problems are more quickly identified and resolved. Standards development organizations that charge for their standards may gain less benefit from this "law" to the extent that fewer people review them.

Other benefits our respondents report include improving the organizational reputation through active contribution and participation (79%), increasing the desirability of the organization's culture (75%), and fulfilling an implicit moral obligation that comes with benefiting from the use of open standards (74%). These "soft" benefits can make the organization a better place to work, helping to attract better talent, which indirectly drives up customer value and overall satisfaction.

Increasing involvement in open standards drives strategic and tactical improvement

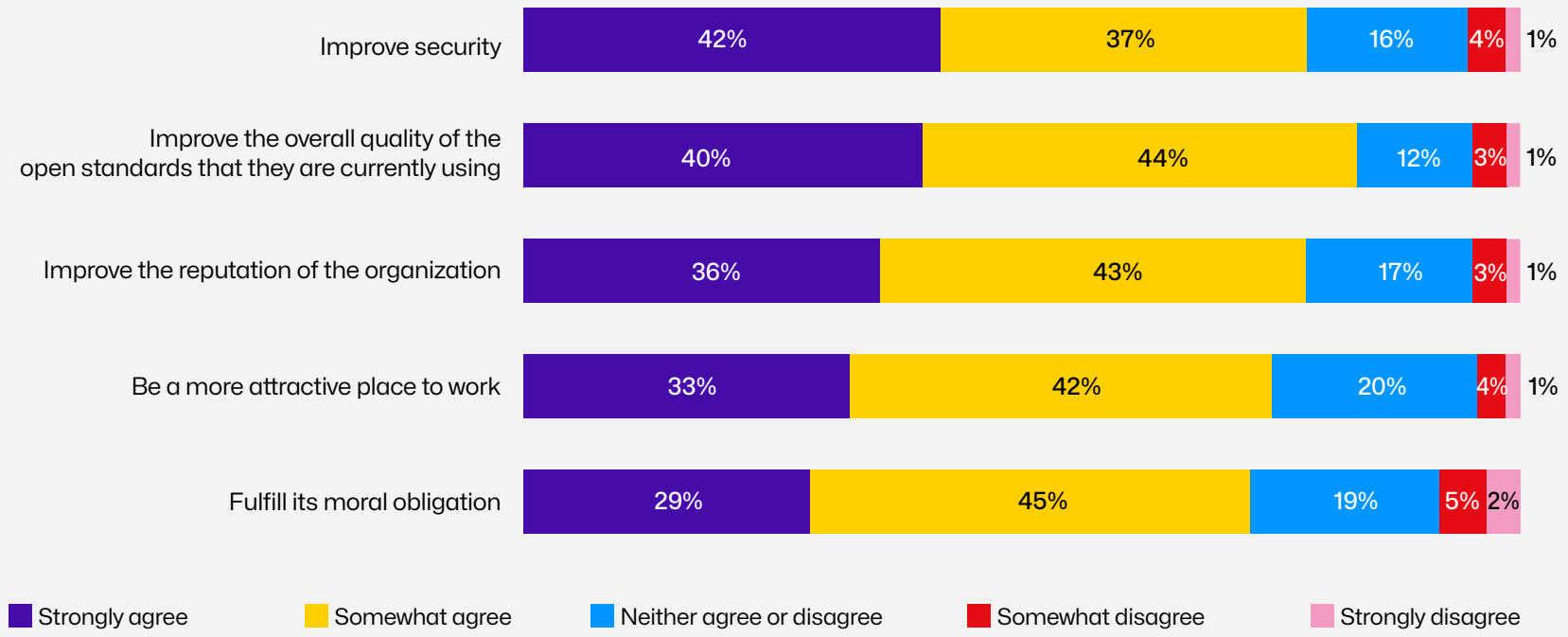
Open standards have become increasingly important in the global business landscape, offering numerous advantages to organizations, as we have identified throughout this study. **FIGURE 14** suggests a positive cause-and-effect relationship between the increased adoption of open standards and improvements in areas where open standards have proven valuable, such as competitiveness, innovation, and security. Actively participating in the development and adoption of open standards can help organizations stay ahead by fostering a culture of innovation and marketplace competitiveness and ensuring the robustness and security of their products and services.

In addition to strategic benefits, **FIGURE 14** reveals several tactical and indirect advantages associated with the increased adoption of open standards, such as improved productivity, reduced total cost of ownership, less vendor lock-in, and a more attractive workplace. By adopting open standards, organizations can streamline their operations, minimize costs, promote flexibility, and attract top talent in the industry.

FIGURE 13

WHY ORGANIZATIONS SHOULD CONTRIBUTE TO OPEN STANDARDS

Why should your organization contribute to open standards development? (select one response per row)

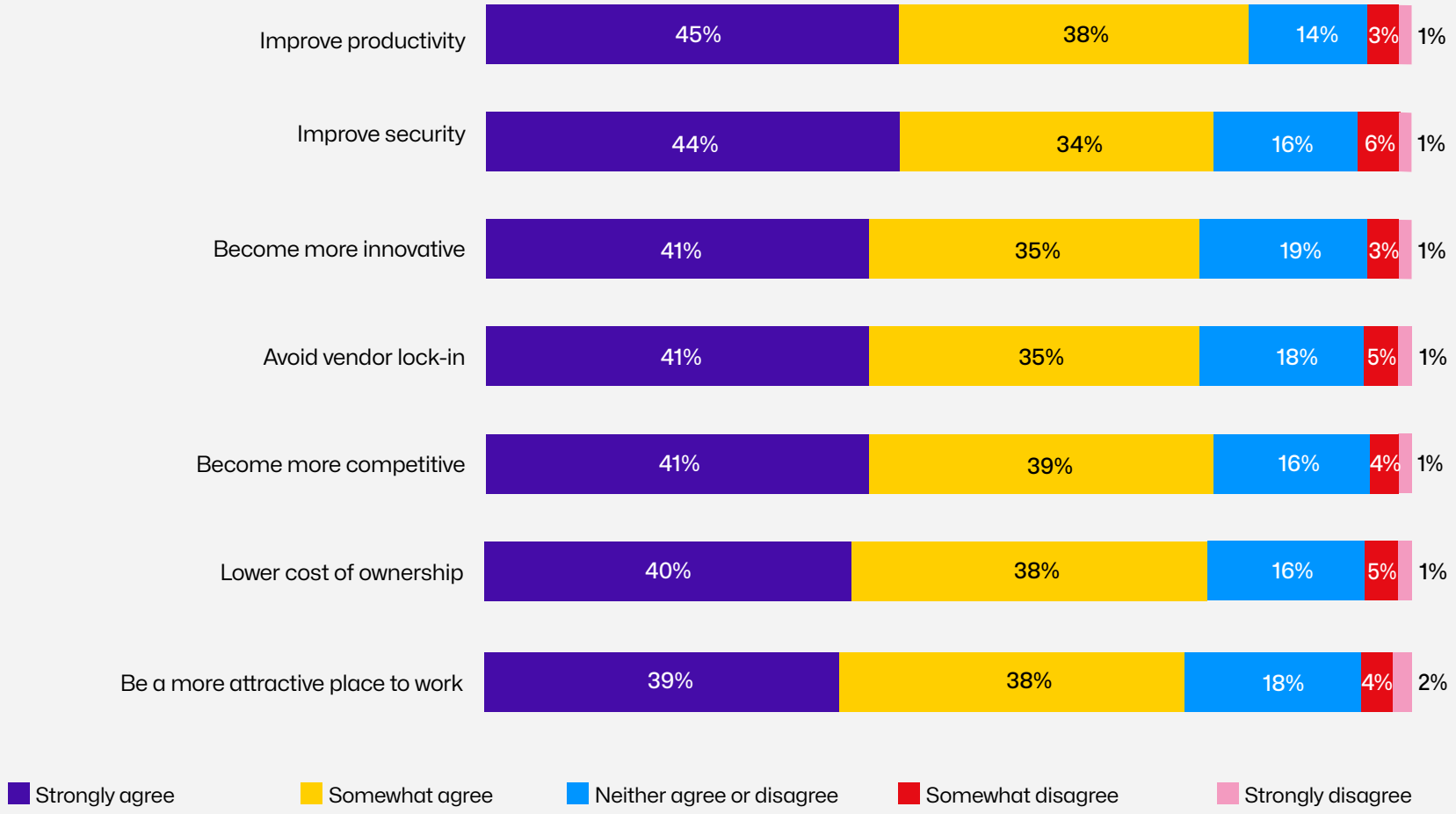


2023 STATE OF OPEN STANDARDS SURVEY, Q45 (TABLE A59), SAMPLE SIZE=496, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

FIGURE 14

BENEFITS FROM INCREASED ADOPTION OF OPEN STANDARDS

My organization should increase its adoption of open standards to: (select one response per row)



2023 STATE OF OPEN STANDARDS SURVEY, Q39 (TABLE A46), SAMPLE SIZE = 410, N/A RESPONSES EXCLUDED FROM THE ANALYSIS.

Conclusions

Open standards are an ideal approach for the widest diffusion and adoption of a technology. The overwhelming support for open standards indicates that we have passed the inflection point where the utility of open standards is greater than more restrictive approaches to standards. This survey reviewed a wide variety of attitudes about standards. Results consistently show that involvement in, preference for, and adoption of open standards are widely greater than restrictive standards. The benefits delivered by open standards were also reported to extend beyond the organization's boundaries, accelerating competition and innovation within markets and industries. Open standards are driving more benefits in innovation and competitiveness (particularly for small organizations) and more value to organizations over time and delivering more positive transformational benefits for contributing. These factors, combined with the necessary characteristics of open standards, accelerate innovation and spread standards across industries further and more quickly.

Key findings that have emerged as a result of this research include that 80% of organizations say that open standards make them more competitive, 76% say that increased use of open standards is making them more innovative, and 71% prefer open standards. These findings tell us that organizations have determined that open standards are a more efficient path to being more innovative and competitive. If the trends identified in this survey persist, it may be that other approaches to standards-making will be increasingly relegated to specialized use cases.

Our research shows continued organizational participation in royalty-bearing standards activities, despite overwhelming support and preference for RF open standards. RAND standards remain prevalent where an extraordinary commitment and investment in technology is needed to make a meaningful advance and in older industries where proprietary technologies have dominated or limited competition (e.g., due to the cost or complexity of entering a market). Quantum computing is such an example. While many patents have been filed for quantum computing, open projects, such as IBM's Qiskit,[18] the University of Waterloo's libOQS for quantum-safe computing,[19] and Quil,[20] a programming language for quantum computations, are emerging to encourage greater compatibility and alignment across the field. As markets grow, technologies commoditize, and costs decrease, open technologies will proliferate within a given industry and eventually displace royalty-bearing standards as the dominant approach.

Organizations are drawn to open standards as the solution of choice for their strategic needs. Developers and adopters of standards clearly prefer open standards. Our results show that organizations highly value several benefits of open standards: Enabling market-wide innovation and competition, supporting new and innovative products and services, addressing market needs in a timely way, meeting customer preferences, lowering the total cost of ownership, and facilitating participation. Additionally, organizations believe that these benefits outweigh patent royalty opportunities and, in many cases, rely on open standards as a selling point for products and services. Over the past three years, the value derived from open standards has increased in organizations 13 times more than it has decreased. As organizations incorporate open standards further into their technology strategy, there can be no doubt that the value of open standards will continue to grow, providing a greater ROI.

About this study

This study is based on a web survey conducted by the Linux Foundation and its partners in January 2023. In the following, we present the demographics of the respondents and the study methodology.

From a research perspective, it was important to eliminate any perception of sample bias and also ensure high data quality. Eliminating sample bias was addressed by sourcing 60% of our usable sample from a third-party panel provider, 31% from Linux Foundation partner communities, and 9% from Linux Foundation membership. Data quality was addressed through extensive pre-screening and screening criteria to ensure that respondents had sufficient familiarity and professional experience to answer questions accurately on behalf of the organization they worked for.

Demographics

FIGURE 15 presents the demographics of the respondent organizations. In terms of organization size based on the number of employees, we classified respondents into small (1–249), medium (250–999), large (1,000–9,999), and enterprise-level (10,000+) organizations. A similar number of respondents from each organization size participated in the survey: 29% for small, 23% for medium, 26% for large, and 22% for enterprise-level. Regarding geographic region, the middle panel in **FIGURE 15** shows the region where the organizations have their primary headquarters. Almost half of the organizations are in the U.S. or Canada, 27% are in Europe, and 22% are in the Asia-Pacific region. The panel on the right provides a window into the organization's primary industry. Overall, information technology (IT vendor, service provider, or manufacturer) accounts for 41% of the sample, and other industries account for 59% of the sample. The strong showing of IT is not surprising, given the survey's focus. Other named industries, totaling 28%, are telecommunications, automotive, media, construction, education, government, and others (accounting for less than 4% in the sample).

FIGURE 16 shows some demographics of the respondents. Respondents are very/extremely familiar with standards (73%), work full-time (92%), and mostly occupy technical and leadership positions, as seen in **FIGURE 16**.

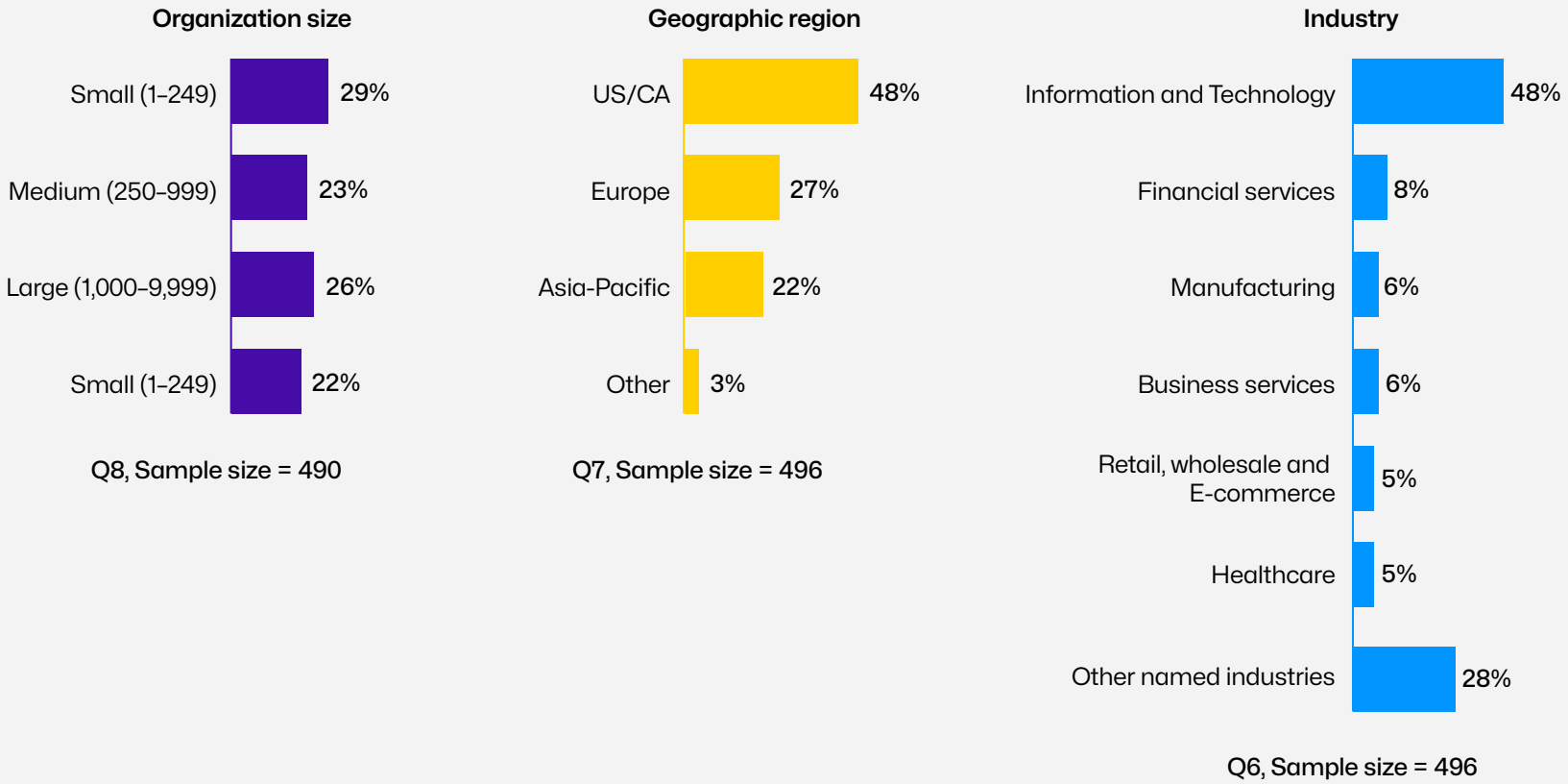
Methodology and open results data

This survey approached the subject of standards in a simplistic way. The survey, while useful in evaluating alignment with the open and closed endpoint in the standards continuum, did not examine the nuanced nature of this continuum. It is therefore important to recognize that the survey results in this report, while effective at highlighting the polarization that exists in open and closed standards, do not capture the different ways that open and closed (or restrictive) standards are influenced by each other across the standards continuum. Linux Foundation Research understands that follow-on research that addresses a more nuanced view of standards is necessary. However, this survey does effectively communicate the seismic change that open standards are creating in the standards continuum.

The figures in this report and the tables in the Appendix include in their title the actual text of the question that was asked in the survey. This is done so that the reader can see exactly what we asked. At the same time, the commentary in this report reflects an evolved thinking of standards nomenclature that substitutes the term "restrictive" in place of "closed" as a first step in the more nuanced way in which standards need to be compared and evaluated.

FIGURE 15

ORGANIZATIONAL DEMOGRAPHIC



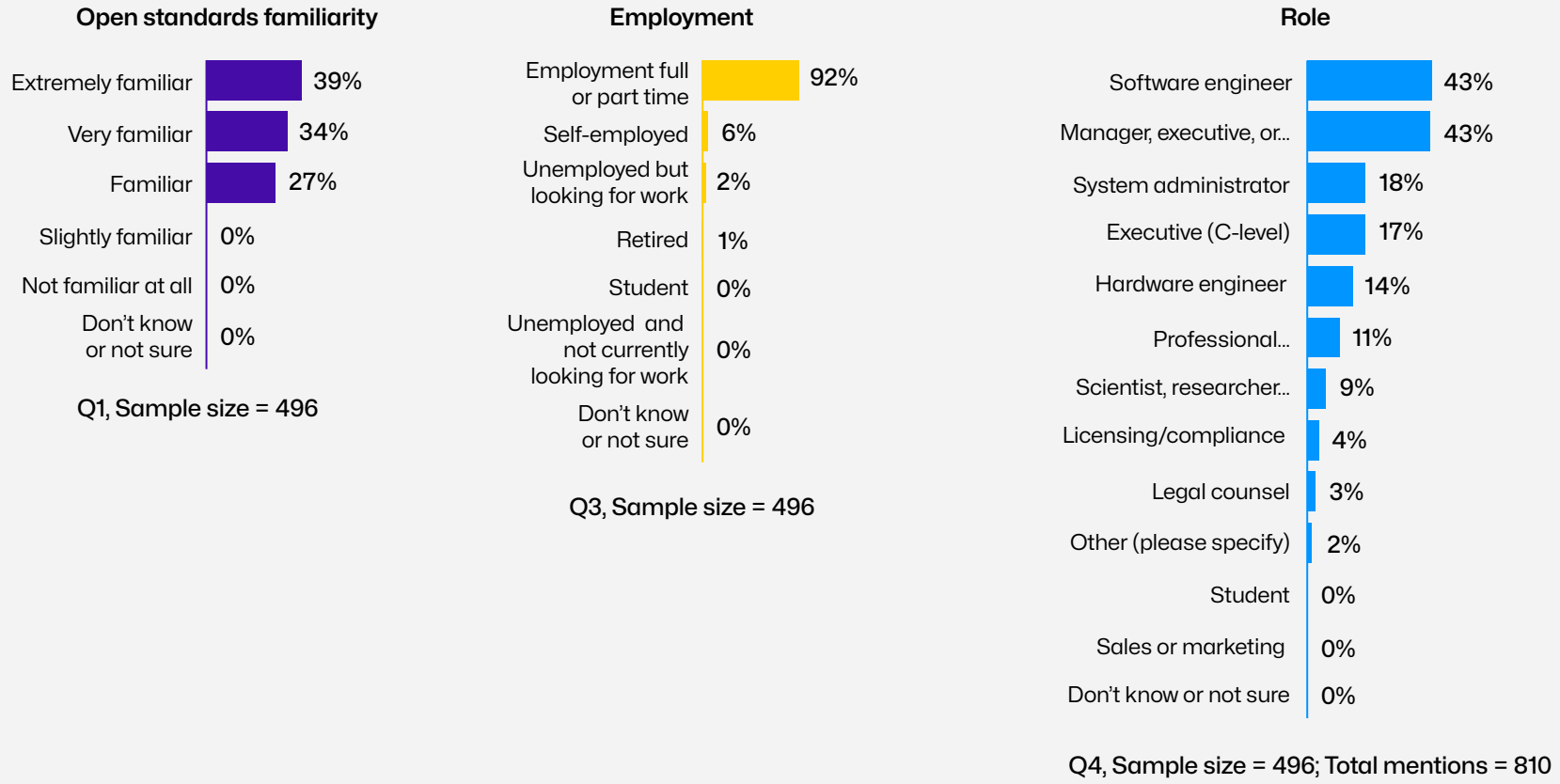
The study data were collected via an online survey that was open from December 21, 2022, to February 6, 2023, and was promoted via social media, the Linux Foundation and Linux.com websites, and the Linux Foundation Newsletter and with the support of the following partners: the JDF, Green Software Foundation, OpenUK, Ecma International, OpenChain, SPDX, Trust Over IP, C2PA, GraphQL, and RISC-V. We also hired a third-party panel provider (60% of the final sample) to promote more diversity of answers.

The final sample size analyzed for the survey was 496. This sample size only includes those respondents who passed a variety of screening and filtering criteria. These 496 responses were obtained from the aforementioned sources:

- 295 (60%) responses from a third-party panel. These respondents are primarily IT end-user organizations and have no affiliation with the Linux Foundation.

FIGURE 16

RESPONDENT DEMOGRAPHICS. CHARACTERISTICS WITH 0% (E.G., "SLIGHTLY FAMILIAR" AND "NOT FAMILIAR AT ALL") MAY BE A RESULT OF THE APPLICATION OF THE SCREENING CRITERIA.



- 155 (31%) responses from Linux Foundation Research partners: Ecma International, SPDX, RISC-V International, JDF, Open Chain, and OCI.
- 46 (9%) responses from Linux Foundation community members.

For more details about the screening criteria used and access to the survey dataset, see http://www.data.world/thelinuxfoundation.

How missing data is handled: Although respondents are required to answer nearly all questions in the survey (the only exceptions are the open-ended questions), there are times

when a respondent is unable to answer a question because it is outside the scope of their role or experience. For this reason, we frequently add a "Don't know or not sure" (DKNS) response to the list of responses for a question. However, this creates a conundrum regarding what to do with DKNS responses.

One approach is to treat it just like any other response. In this way, report readers can see the percentage of respondents that answered DKNS. The advantage of this approach is that it reports back the exact distribution of the data collected. The challenge with this approach is that it distorts the distribution of valid responses—those responses where respondents could answer the question.

Some of the analyses in this report excluded the DKNS responses. This can be done because the data missing can be classified 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 percentage of responses across the remaining responses. This has the effect of proportionally increasing the percentage values of the remaining responses relative to the number of DKNS responses. The number of valid cases is adjusted accordingly. Where we have elected to exclude DKNS data, a careful examination of the footnote for the figure will enable the reader to determine the number of DKNS responses based on the difference between the sample size (DKNS included) and valid cases (DKNS excluded).

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

Appendix A

The contents of Appendix A include a frequency for every question and selected crosstabs referenced in the report. Free text questions (Q15–Q18, Q30, and Q46) are not included in this Appendix. For a complete PDF of the survey instrument, see http://www.data.world/thelinuxfoundation. Appendix A is organized as follows:

FIGURES	QUESTIONS	CATEGORIES
A1–A8	1–8	Demographics
A9–A12	9–12	Organizational information
A13–A15	13–19	Organizational involvement in standards
A16–A44	20–37	Value of open standards
A45–A50	38–42	Growth of standards
A51–A60	43–47	Developing open standards

TABLE	QUESTIONS	COUNT	PERCENTAGE
A1	Q1: How familiar are you with open standards in information technology?		
	Extremely familiar	193	39%
	Very familiar	169	34%
	Familiar	134	27%
	Slightly familiar	0	0%
	Not familiar at all	0	0%
	Don't know or not sure	0	0%
	Total	496	
A2	Q2: Which response best describes you?		
	I am a real person	496	100%
	Don't know or not sure	0	0%
	I'm just lines of code filling out forms on the Internet	0	0%
	I am a useless bot	0	0%
	I just want to mess with the researchers	0	0%
	Total	496	100%

TABLE	QUESTIONS	COUNT	PERCENTAGE
A3	**Q3: Which statement best describes your employment situation?**		
	Employed full or part time	454	92%
	Self-employed	29	6%
	Unemployed but looking for work	8	2%
	Retired	5	1%
	Don't know or not sure	0	0%
	Student	0	0%
	Unemployed and not currently looking for work	0	0%
	Total	496	
A4	**Q4: Which of the following roles or titles best describe you?**		
	Software engineer	213	43%
	Manager, executive, or leader	212	43%
	System administrator	91	18%
	Executive (C-level)	83	17%
	Hardware engineer	68	14%
	Professional services / consultant	53	11%
	Scientist, researcher, academic, professor, or specialist	44	9%
	Licensing / compliance	20	4%
	Legal counsel	15	3%
	Other (please specify)	11	2%
	Don’t know or not sure	0	0%
	Student	0	0%
	Sales or marketing	0	0%
	Total	496	
A5	**Q5: What best describes the organization you work for?**		
	My organization primarily consumes IT products or services (e.g., software, cloud, systems) to support its business activity	214	43%
	My organization develops or provides IT solutions and products (e.g., software, cloud, systems)	211	43%
	I work for a non-profit association or foundation	19	4%
	I work for another organization type (please specify)	14	3%
	I am an independent contractor supporting corporate clients	14	3%
	I work for a government entity or agency	14	3%
	I work for an academic or research institution	10	2%
	Total	496	

TABLE	QUESTIONS	COUNT	PERCENTAGE
A6	Q6: Which of the following best describes your organization's primary industry?		
	Information technology (IT vendor, service provider, or manufacturer)	205	41%
	Financial services (banking, insurance, securities, etc.)	42	8%
	Manufacturing (discrete or process)	31	6%
	Business services (accounting, management consulting, legal, etc.)	28	6%
	Retail, wholesale, & eCommerce	27	5%
	Health care	24	5%
	Other (please specify)	18	4%
	Telecommunications / Internet service provider (ISP) / web hosting	16	3%
	Automotive	15	3%
	Media (broadcast communications, entertainment, publishing, website, social networking, etc.)	15	3%
	Construction / engineering	14	3%
	Education (college, university)	12	2%
	Government (state, local)	11	2%
	Consumer packaged goods	8	2%
	Transportation & logistics (other than automotive)	6	1%
	Life sciences (biotech, pharmaceuticals, etc.)	6	1%
	Utilities / energy	6	1%
	Government (federal, national)	4	1%
	Hospitality, travel	4	1%
	Mining, oil, and gas	2	0%
	Agriculture	2	0%
	Education (K-12, primary, secondary)	0	0%
	Total	496	
A7	Q7: In which region does your organization have its primary headquarters?		
	North America (Canada, U.S.)	236	48%
	Europe (eastern & western, excluding Russia)	132	27%
	Oceania (including Australia & New Zealand)	40	8%
	China	28	6%
	Japan	25	5%
	Asia (except China, India, Japan, Russia, and Oceania)	11	2%
	South America	8	2%

TABLE	QUESTIONS	COUNT	PERCENTAGE
	India	5	1%
	Mexico, Central America, and the Caribbean	4	1%
	Other (please specify)	2	0%
	Eastern and Southern Africa	2	0%
	Middle East	1	0%
	North Africa	1	0%
	West and Central Africa	1	0%
	Russia	0	0%
	Total	496	
A8	Q8: Please estimate how many employees the organization you work for has worldwide.		
	Don't know or not sure	6	1%
	10 or less	36	7%
	11 to 49	40	8%
	50 to 249	64	13%
	250 to 999	112	23%
	1,000 to 9,999	128	26%
	10,000 to 19,999	30	6%
	20,000 or more	80	16%
	Total	496	
A9	Q9: How much does IT drive your organization's product and service profitability?		
	Don't know or not sure	4	1%
	Not IT-driven at all	4	1%
	Slightly IT-driven	12	2%
	Somewhat IT-driven	68	14%
	Very IT-driven	172	35%
	Extremely IT-driven	236	48%
	Total	496	

TABLE	QUESTIONS	COUNT	PERCENTAGE
A10	Q10: How innovative would you say your company is?		
	Don't know or not sure	1	0%
	Not innovative at all	3	1%
	Slightly innovative	26	5%
	Somewhat innovative	112	23%
	Very innovative	191	39%
	Extremely innovative	163	33%
	Total	496	
A11	Q11: How much does your organization use OSS either as an end user or in solutions you sell?		
	Don't know or not sure	2	0%
	Not OSS-centric at all	12	2%
	Slightly OSS-centric	27	5%
	Somewhat OSS-centric	120	24%
	Very OSS-centric	202	41%
	Extremely OSS-centric	133	27%
	Total	496	
A12	Q12: How much does your organization contribute to OSS?		
	Don't know or not sure	7	1%
	Not OSS contribution-focused at all	36	7%
	Slightly OSS contribution-focused	89	18%
	Somewhat OSS contribution-focused	126	25%
	Very OSS contribution-focused	155	31%
	Extremely OSS contribution-focused	83	17%
	Total	496	
A13	Q13: What is your organization's relationship with open standards?		
	My organization develops products, solutions, or services that conform to certain open standards	285	57%
	My organization contributes to the development of one or more open standards	258	52%
	My organization leads the development of one or more open standards	152	31%
	Don't know or not sure	22	4%
	My organization does not use or contribute to open standards	18	4%
	Other (please specify)	8	2%

TABLE	QUESTIONS	COUNT	PERCENTAGE
A14	**Q14: What is your organization's relationship with closed standards?**		
	My organization develops products, solutions, or services that conform to certain closed standards	205	41%
	My organization contributes to the development of one or more closed standards	183	37%
	My organization leads the development of one or more closed standards	110	22%
	My organization does not use or contribute to closed standards	65	13%
	Don't know or not sure	53	11%
	Other (please specify)	14	3%
A15	**Q19: Is your organization a member of one or more standards bodies?**		
	ISO (International Organization for Standardization), IEC (International Electrotechnical Commission), or ISO/IEC JTC 1	115	24%
	We're not affiliated with any standards body	108	23%
	Linux Foundation or Joint Development Foundation	106	23%
	IoT standards bodies (e.g., Bluetooth Special Interest Group, OneM2M, Open Interconnectivity Foundation)	91	19%
	ANSI (American National Standards Institute)	83	18%
	Telecommunications standards bodies (e.g., 3GPP, ITU-T, GSMA)	72	15%
	IEEE	64	14%
	CEN, CENELEC, ETSI (or other E.U. standards bodies)	59	13%
	IETF (Internet Engineering Task Force)	57	12%
	Don't know or not sure	53	11%
	W3C (World Wide Web Consortium)	51	11%
	IAB (Internet Architecture Board)	43	9%
	ACORD (or other AP standard bodies)	37	8%
	Ecma International	34	7%
	Non-IT industry standards bodies (e.g., AEC in automotive, AAIS - American Association of Insurance Services)	33	7%
	OASIS Open	32	7%
	Other (please specify)	24	5%
A16	**Q20: What characteristics do you believe are necessary for a standard to be an open standard?**		
	Final specification openly published and accessible	269	61%
	Developed using an open process (i.e., open for public review and debate)	242	55%
	Royalty free for implementers	239	54%
	Draft specifications openly published and accessible	206	47%

TABLE	QUESTIONS	COUNT	PERCENTAGE
	Have open source implementations	203	46%
	Free from legal or technical clauses that limit its utilization	197	45%
	Managed independently of any single vendor	151	34%
	Created by domain experts	150	34%
	Employ license terms that protect against subversion of the standard	149	34%
	Safe for governments to endorse	131	30%
	Other (please specify)	5	1%
	Don't know or not sure	3	1%
A17	**Q21: What characteristics do you believe are necessary for a standard to be a closed standard?**		
	A closed development model that protects draft conversations and IP during development	257	58%
	The final specification is only accessible to members	179	40%
	Royalty payments for standards' essential patents	174	39%
	At least some elements of the final specification are publicly published and accessible	166	38%
	Don't know or not sure	26	6%
	Other (please specify)	9	2%

A18	Q22: How do open standards impact the availability of competitive solutions in the market?						
		N/A	Decreases a lot	Decreases slightly	No change	Increases slightly	Increases a lot
	Competitiveness in the short run	6 (1%)	7 (2%)	25 (6%)	74 (17%)	188 (43%)	142 (32%)
	Competitiveness in the long run	5 (1%)	6 (1%)	19 (4%)	64 (15%)	142 (33%)	198 (46%)

A19	Q23: How do open standards impact market innovation?						
		N/A	Decreases a lot	Decreases slightly	No change	Increases slightly	Increases a lot
	Innovation in the short run	4 (1%)	8 (2%)	21 (5%)	66 (15%)	182 (41%)	160 (36%)
	Innovation in the long run	5 (1%)	5 (1%)	17 (4%)	62 (14%)	124 (28%)	225 (51%)

TABLE	QUESTIONS		COUNT	PERCENTAGE
A20	**Q24: How does your organization generally derive value from standards?**			
	Selling services around implementing, using, or integrating with the standard		245	55%
	Selling products or solutions into a market created around the standard		223	50%
	Selling products or solutions built around the standard		211	48%
	Collecting royalties from technology we have patented		73	17%
	Don't know or not sure		31	7%
	Other (please specify)		17	4%
A21	**Q24: How does your organization generally derive value from standards? segmented by Q7: In which region does your organization have its primary headquarters?**			
		United States/Canada	Europe	Asia-Pacific
	Selling products or solutions built around the standard	105 (51%)	57 (47%)	43 (43%)
	Selling products or solutions into a market created around the standard	108 (53%)	56 (46%)	48 (48%)
	Selling services around implementing, using, or integrating with the standard	124 (60%)	63 (52%)	51 (52%)
	Collecting royalties from technology we have patented	39 (19%)	9 (7%)	21 (21%)
	Other (please specify)	9 (4%)	6 (5%)	1 (1%)
	Don't know or not sure	13 (6%)	10 (8%)	7 (7%)
A22	**Q25: What percentage of your organization's revenue is derived from closed standard royalties?**			
	Don't know or not sure		63	14%
	0%		100	23%
	1 to 20%		83	19%
	21 to 40%		81	18%
	41 to 60%		66	15%
	61 to 80%		37	8%
	81 to 99%		9	2%
	100%		3	1%
	Total		442	

TABLE	QUESTIONS	COUNT	PERCENTAGE
A23	Q25a: What percentage of your organization's revenue is derived from closed standard royalties? (regrouped)		
	0%	100	26%
	1 to 20%	83	22%
	21 to 40%	81	21%
	More than 40%	115	30%
	Total	379	
A24	Q26: What percentage of your organization's profit is derived from closed standard royalties?		
	Don't know or not sure	68	15%
	0%	100	23%
	1 to 5%	45	10%
	6 to 20%	69	16%
	21 to 40%	65	15%
	41 to 60%	52	12%
	61 to 80%	30	7%
	81 to 99%	11	2%
	100%	2	0%
	Total	442	
A25	Q26a: What percentage of your organization's profit is derived from closed standard royalties? (regrouped)		
	0%	100	27%
	1 to 20%	114	30%
	21 to 40%	65	17%
	More than 40%	95	25%
	Total	374	
A26	Q27: From a revenue point of view, which side of your business is growing faster?		
	Products or solutions	266	78%
	Patent licensing	49	14%
	Don't know or not sure	25	7%
	Total	340	

TABLE	QUESTIONS	COUNT				PERCENTAGE	
A27	**Q28: Which type of standard (open or closed) better supports these market needs? Preference for open standards.**						
		N/A	Definitely closed standards	Slightly closed standards	The same	Slightly open standards	Definitely open standards
	Addressing market needs in a timely manner	4 (1%)	17 (4%)	45 (11%)	95 (23%)	119 (28%)	141 (33%)
	Creating new and innovative products and services	5 (1%)	17 (4%)	36 (9%)	99 (24%)	119 (28%)	144 (34%)
	Enabling market-wide innovation	6 (1%)	9 (2%)	31 (7%)	86 (21%)	119 (28%)	167 (40%)
	Enabling market-wide competition	4 (1%)	7 (2%)	29 (7%)	97 (23%)	109 (26%)	171 (41%)
A28	**Preference for open standards: aggregation of Q28 and Q33-35, segmented by Q8: Please estimate how many employees the organization you work for has worldwide.**						
		Small	Medium	Large		Enterprise	
	Addressing market needs in a timely manner	64 (71%)	59 (67%)	79 (83%)		56 (73%)	
	Creating new and innovative products and services	63 (70%)	71 (81%)	74 (78%)		53 (69%)	
	Enabling market- wide innovation	77 (86%)	67 (76%)	67 (71%)		72 (94%)	
	Enabling market- wide competition	77 (86%)	67 (76%)	67 (71%)		72 (94%)	
	Accelerate the widespread adoption of a standard within the market	80 (70%)	72 (70%)	78 (67%)		69 (83%)	
	Which model does your organization prefer?	87 (76%)	71 (70%)	77 (66%)		55 (65%)	
A29	**Q29: How much do you agree with the following statements about open and closed standards?**						
		N/A	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
	Without patent royalties, standards do not provide value to my organization	21 (5%)	94 (22%)	66 (16%)	72 (17%)	115 (27%)	54 (13%)
	Patent royalties from our organization's IP adopted into standards offer a great return on investment	49 (12%)	46 (11%)	37 (9%)	70 (17%)	139 (33%)	79 (19%)
	The benefits of open standards outweigh the patent royalty opportunities for my organization	24 (6%)	6 (1%)	23 (5%)	77 (18%)	142 (34%)	148 (35%)
	Open standards promote competition within the markets where my organization competes	15 (4%)	4 (1%)	20 (5%)	57 (14%)	163 (39%)	162 (38%)
	My organization relies on open standards as a selling point for products or services	20 (5%)	9 (2%)	26 (6%)	77 (18%)	150 (36%)	138 (33%)
	My customers prefer to use products and services based on open standards	20 (5%)	9 (2%)	25 (6%)	77 (18%)	152 (36%)	135 (32%)
	I would like to see more open standards in my industry	7 (2%)	5 (1%)	12 (3%)	54 (13%)	138 (33%)	203 (48%)

TABLE	QUESTIONS	COUNT	PERCENTAGE
A30	Q29: How much do you agree with the following statements about open and closed standards? segmented by Q7: In which region does your organization have its primary headquarters?		

		United States/Canada	Europe	Asia-Pacific
	Without patent royalties, standards do not provide value to my organization	71 (38%)	41 (38%)	49 (53%)
	I would like to see more open standards in my industryA39	165 (89%)	91 (83%)	72 (78%)
	Patent royalties from our organization's IP adopted into standards offer a great return on investment	96 (52%)	46 (42%)	67 (73%)
	The benefits of open standards outweigh the patent royalty opportunities for my organization	132 (71%)	73 (67%)	71 (77%)
	Open standards promote competition within the markets where my organization competes	153 (82%)	87 (80%)	73 (79%)
	My organization relies on open standards as a selling point for products or services	137 (74%)	76 (70%)	66 (72%)
	My customers prefer to use products and services based on open standards	137 (74%)	74 (68%)	65 (71%)

A31	Q29: How much do you agree with the following statements about open and closed standards? segmented by Q8: Please estimate how many employees the organization you work for has worldwide.				
		Small	Medium	Large	Enterprise
	Without patent royalties, standards do not provide value to my organization	168 (42%)	30 (27%)	49 (51%)	65 (60%)
	I would like to see more open standards in my industry	338 (85%)	95 (86%)	84 (87%)	90 (83%)
	Patent royalties from our organization's IP adopted into standards offer a great return on investment	216 (54%)	40 (36%)	66 (68%)	70 (64%)
	The benefits of open standards outweigh the patent royalty opportunities for my organization	286 (72%)	79 (72%)	75 (77%)	77 (71%)
	Open standards promote competition within the markets where my organization competes	322 (81%)	87 (79%)	85 (88%)	84 (77%)
	My organization relies on open standards as a selling point for products or services	284 (72%)	76 (69%)	72 (74%)	79 (72%)
	My customers prefer to use products and services based on open standards	285 (72%)	70 (64%)	72 (74%)	88 (81%)

TABLE	QUESTIONS	COUNT				PERCENTAGE	
A32	Q31: How much do you agree with the following statements about open standards?						
		N/A	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
	Offering open source implementation improves the quality of a standard	1 (0%)	3 (1%)	18 (4%)	55 (13%)	159 (38%)	184 (44%)
	Open standards are important to the development of open source software	1 (0%)	7 (2%)	12 (3%)	33 (8%)	131 (31%)	237 (56%)
	Open standards promote interoperability that reduces switching and upgrade costs	4 (1%)	8 (2%)	12 (3%)	43 (10%)	135 (32%)	218 (52%)
	Open standards accelerate the standardization process	3 (1%)	9 (2%)	14 (3%)	64 (15%)	164 (39%)	165 (39%)
A33	Q32: Which of the following are barriers to the widespread adoption of a standard?						
	Confidentiality requirements and limiting participation in the development process			244		58%	
	The time, complexity, and cost of licensing essential patents			213		51%	
	Lack of control about the directions, changes, and support in private development			179		43%	
	Resolving disputes on technical elements			175		42%	
	None of the above			25		6%	
	Don't know or not sure			14		3%	
A34	Q33: Which model of standards development (open vs. closed) would best accelerate adoption?						
	Don't know or not sure			7		2%	
	Definitely closed standards			9		2%	
	Slightly closed standards			28		7%	
	The same			76		18%	
	Slightly open standards			120		29%	
	Definitely open standards			181		43%	
	Total			421			
	Don't know or not sure			7		2%	
A35	Q34: Which model of standards development (open vs. closed) does your organization prefer?						
	Don't know or not sure			12		3%	
	Definitely closed standards			13		3%	
	Slightly closed standards			27		6%	

TABLE	QUESTIONS			COUNT	PERCENTAGE
	The same			77	18%
	Slightly open standards			129	31%
	Definitely open standards			163	39%
	Total			421	
A36	**Q34: Which model of standards development (open vs. closed) does your organization prefer? segmented by Q6: Which of the following best describes your organization's primary industry?**				
				IT	Other industries
	Don't know or not sure			3 (2%)	9 (4%)
	Definitely closed standards			4 (2%)	9 (4%)
	Slightly closed standards			8 (5%)	19 (7%)
	The same			30 (18%)	47 (18%)
	Slightly open standards			35 (21%)	94 (37%)
	Definitely open standards			84 (51%)	79 (31%)
A37	**Q34: Which model of standards development (open vs. closed) does your organization prefer? segmented by Q7: In which region does your organization have its primary headquarters?**				
		United States/Canada		Europe	Asia-Pacific
	Don't know or not sure	8 (4%)		3 (3%)	1 (1%)
	Definitely closed standards	6 (3%)		2 (2%)	4 (4%)
	Slightly closed standards	8 (4%)		11 (10%)	8 (8%)
	The same	31 (16%)		21 (19%)	22 (22%)
	Slightly open standards	57 (29%)		32 (29%)	35 (36%)
	Definitely open standards	85 (44%)		43 (38%)	28 (29%)
A38	**Q34: Which model of standards development (open vs. closed) does your organization prefer? segmented by Q8: Please estimate how many employees the organization you work for has worldwide.**				
		Small	Medium	Large	Enterprise
	Don't know or not sure	2 (2%)	0 (0%)	4 (3%)	6 (7%)
	Definitely closed standards	4 (3%)	4 (4%)	4 (3%)	1 (1%)
	Slightly closed standards	4 (3%)	7 (7%)	10 (9%)	5 (6%)
	The same	18 (16%)	20 (20%)	21 (18%)	17 (20%)
	Slightly open standards	36 (31%)	33 (32%)	37 (32%)	23 (27%)

TABLE	QUESTIONS			COUNT	PERCENTAGE
	Definitely open standards	51 (44%)	38 (37%)	40 (34%)	32 (38%)
A39	**Q34: Which model of standards development (open vs. closed) does your organization prefer? segmented by Q13: What is your organization's relationship with open standards?**				
		Adopters		Developers	No relationship
	Don't know or not sure	7 (6%)		3 (1%)	0 (0%)
	Definitely closed standards	6 (5%)		6 (2%)	1 (8%)
	Slightly closed standards	7 (6%)		20 (7%)	0 (0%)
	The same	19 (17%)		51 (18%)	5 (42%)
	Slightly open standards	32 (28%)		86 (31%)	3 (25%)
	Definitely open standards	42 (37%)		113 (41%)	3 (25%)
A40	**Q35: For video streaming codec standards, which approach provides the most innovation value?**				
	Don't know or not sure			37	9%
	Definitely closed standards			14	3%
	Slightly closed standards			39	9%
	The same			73	17%
	Slightly open standards			92	22%
	Definitely open standards			166	39%
	Total			421	
A41	**Q35: For video streaming codec standards, which approach provides the most innovation value? (DKNS responses excluded)**				
	Definitely closed standards			14	4%
	Slightly closed standards			39	10%
	The same			73	19%
	Slightly open standards			92	24%
	Definitely open standards			166	43%
	Total			384	

TABLE	QUESTIONS	COUNT	PERCENTAGE
A42	Q36: Is there a need for an open standard video streaming codec that is royalty free?		
	Yes	284	67%
	No	48	11%
	Don't know or not sure	89	21%
	Total	421	
A43	Q36: Is there a need for an open standard video streaming codec that is royalty free? (DKNS responses excluded)		
	Yes	284	86%
	No	48	14%
	Total	332	
A44	Q37: How would negotiated royalty fees for open standards you use impact your business?		
	Don't know or not sure	43	10%
	Not impactful at all	12	3%
	Slightly impactful	56	13%
	Somewhat impactful	102	24%
	Very impactful	118	28%
	Extremely impactful	90	21%
	Total	421	
A45	Q38: Which factors influence your organization's decision to use a particular open standard?		
	Security	212	52%
	Quality of the standard or technical documentation	181	44%
	Reliability	179	44%
	Availability of an open source implementation	172	42%
	License Policy	150	37%
	Community's activity and engagement levels	133	32%
	Community or third-party support	133	32%
	Tools	133	32%
	Frequency of updates	115	28%
	Process	115	28%
	Availability of a conformance checking tool or test suite	114	28%

TABLE	QUESTIONS	COUNT	PERCENTAGE
	Stakeholders involved in the standardization	102	25%
	Backward compatibility	101	25%
	Availability of a certification or conformance program	95	23%
	Issues with an existing closed standard	77	19%
	Lack of an equivalent closed standard	76	19%
	Other (please specify)	7	2%
	Don't know or not sure	6	1%

A46	Q39: Should my organization increase its adoption of open standards to drive value in these areas?						
		N/A	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
	Become more innovative	12 (3%)	4 (1%)	11 (3%)	77 (19%)	140 (34%)	164 (40%)
	Improve productivity	13 (3%)	3 (1%)	11 (3%)	56 (14%)	150 (37%)	177 (43%)
	Lower cost of ownership	12 (3%)	3 (1%)	20 (5%)	63 (16%)	150 (37%)	157 (39%)
	Improve security	14 (3%)	3 (1%)	22 (5%)	61 (15%)	133 (33%)	174 (43%)
	Avoid vendor lock-in	12 (3%)	3 (1%)	18 (4%)	71 (18%)	138 (34%)	161 (40%)
	Be a more attractive place to work	16 (4%)	6 (1%)	15 (4%)	72 (18%)	147 (36%)	152 (37%)
	Become more competitive	15 (4%)	3 (1%)	14 (3%)	65 (16%)	152 (37%)	160 (39%)

A47	Q40: How long does it take for an open or closed standard to go from an idea to usable standard?		
	Closed Standards	Count	%
	N/A	41	10%
	6 months or less	15	4%
	7 to 12 months	81	20%
	1 to 2 years	138	34%
	2 to 5 years	94	23%
	5 years or more	37	9%
	Total	406	
	Open Standards	Count	%
	N/A	24	6%
	6 months or less	23	6%
	7 to 12 months	68	17%
	1 to 2 years	130	32%

TABLE	QUESTIONS	COUNT	PERCENTAGE
	2 to 5 years	128	32%
	5 years or more	30	7%
	Total	403	
A48	**Q41: Over the last 3 years, how has the value that your organization derives from open standards changed?**		
	Don't know or not sure	25	6%
	It has decreased a lot	2	0%
	It has decreased	16	4%
	It has stayed the same	122	30%
	It has increased	172	42%
	It has increased a lot	73	18%
	Total	410	
A49	**Q42: Over the last 3 years, how has the time and effort your organization contributes to open standards changed?**		
	Don't know or not sure	24	6%
	It has decreased a lot	4	1%
	It has decreased	27	7%
	It has stayed the same	136	33%
	It has increased	149	36%
	It has increased a lot	70	17%
	Total	410	
A50	**Q42: Over the last 3 years, how has the time and effort your organization contributes to open standards changed? (DKNS responses excluded)**		
	It has decreased a lot	4	1%
	It has decreased	27	7%
	It has stayed the same	136	35%
	It has increased	149	39%
	It has increased a lot	70	18%
	Total	386	

TABLE	QUESTIONS	COUNT	PERCENTAGE
A51	**Q43: Where does the need for open standards originate in your organization?**		
	Product need	234	58%
	Engineering ideas	199	49%
	Open source leads	170	42%
	Marketing	113	28%
	Legal need	110	27%
	Sales	81	20%
	We don't use or contribute to open standards	16	4%
	Don't know or not sure	13	3%

A52	Q44: How easy is it to participate in the development of an open or closed standard?						
		N/A	Very difficult	Somewhat difficult	Neither difficult or easy	Somewhat easy	Very easy
	Closed standards	22 (5%)	64 (16%)	74 (18%)	92 (23%)	105 (26%)	45 (11%)
	Open standards	12 (3%)	11 (3%)	63 (16%)	84 (21%)	151 (37%)	85 (21%)

A53	Q44: How easy is it to participate in the development of an open or closed standard? (Open standards only) segmented by Q6: Which of the following best describes your organization's primary industry?		
		IT	Other industries
	N/A	4 (3%)	8 (3%)
	Very difficult	4 (3%)	7 (3%)
	Somewhat difficult	23 (14%)	40 (16%)
	Neither difficult or easy	31 (19%)	53 (21%)
	Somewhat easy	62 (39%)	89 (36%)
	Very easy	35 (22%)	50 (20%)

A54	Q44: How easy is it to participate in the development of an open or closed standard? (Closed standards only) segmented by Q6: Which of the following best describes your organization's primary industry		
		IT	Other industries
	N/A	9 (6%)	13 (5%)
	Very difficult	26 (16%)	38 (16%)
	Somewhat difficult	27 (17%)	47 (19%)

TABLE	QUESTIONS			COUNT	PERCENTAGE
	Neither difficult or easy			36 (23%)	56 (23%)
	Somewhat easy			37 (23%)	68 (28%)
	Very easy			23 (15%)	22 (9%)
A55	**Q44: How easy is it to participate in the development of an open or closed standard? (Open standards only) segmented by Q7: In which region does your organization have its primary headquarters?**				
		United States/Canada		Europe	Asia-Pacific
	N/A	3 (2%)		5 (5%)	4 (4%)
	Very difficult	2 (1%)		3 (3%)	5 (5%)
	Somewhat difficult	25 (13%)		17 (16%)	18 (18%)
	Neither difficult or easy	38 (20%)		19 (18%)	24 (24%)
	Somewhat easy	67 (36%)		46 (43%)	34 (35%)
	Very easy	51 (27%)		16 (15%)	13 (13%)
A56	**Q44: How easy is it to participate in the development of an open or closed standard? (Closed standards only) segmented by Q7: In which region does your organization have its primary headquarters?**				
		United States/Canada		Europe	Asia-Pacific
	N/A	12 (7%)		6 (6%)	4 (4%)
	Very difficult	33 (18%)		23 (22%)	6 (6%)
	Somewhat difficult	31 (17%)		17 (16%)	25 (26%)
	Neither difficult or easy	43 (23%)		16 (15%)	28 (29%)
	Somewhat easy	42 (23%)		32 (30%)	27 (28%)
	Very easy	23 (13%)		11 (10%)	7 (7%)
A57	**Q44: How easy is it to participate in the development of an open or closed standard? (Open standards only) segmented by Q8: Please estimate how many employees the organization you work for has worldwide.**				
		Small	Medium	Large	Enterprise
	N/A	7 (6%)	0 (0%)	3 (3%)	2 (3%)
	Very difficult	3 (3%)	1 (1%)	5 (4%)	2 (3%)
	Somewhat difficult	19 (17%)	13 (13%)	15 (13%)	14 (18%)
	Neither difficult or easy	18 (16%)	24 (24%)	21 (19%)	20 (25%)
	Somewhat easy	43 (39%)	43 (43%)	42 (37%)	23 (29%)
	Very easy	20 (18%)	20 (20%)	27 (24%)	18 (23%)

TABLE	QUESTIONS	COUNT			PERCENTAGE	
A58	Q44: How easy is it to participate in the development of an open or closed standard? (Closed standards only) segmented by Q8: Please estimate how many employees the organization you work for has worldwide.					
		Small	Medium	Large	Enterprise	
	N/A	13 (12%)	1 (1%)	4 (4%)	4 (5%)	
	Very difficult	31 (29%)	10 (10%)	10 (9%)	12 (15%)	
	Somewhat difficult	20 (19%)	20 (20%)	16 (14%)	18 (23%)	
	Neither difficult or easy	15 (14%)	23 (23%)	32 (29%)	21 (27%)	
	Somewhat easy	24 (22%)	25 (25%)	38 (34%)	17 (22%)	
	Very easy	5 (5%)	21 (21%)	12 (11%)	7 (9%)	
A59	Q45: What are the reasons why your organization contributes to open standards development?					
		N/A	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
	Be a more attractive place to work	12 (3%)	3 (1%)	14 (3%)	79 (20%)	164 (41%)	129 (32%)
	Improve the overall quality of the open standards that they are currently using	12 (3%)	3 (1%)	10 (2%)	49 (12%)	174 (43%)	158 (39%)
	Fulfill its moral obligation	14 (3%)	9 (2%)	20 (5%)	74 (18%)	173 (43%)	111 (28%)
	Improve the reputation of the organization	10 (2%)	4 (1%)	11 (3%)	68 (17%)	169 (42%)	141 (35%)
	Improve security	16 (4%)	3 (1%)	16 (4%)	63 (16%)	143 (35%)	162 (40%)
A60	Q47: What influences my organization's willingness to contribute to open standards?					
		N/A	Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
	A lack of time or funding	14 (3%)	30 (7%)	47 (12%)	58 (14%)	152 (38%)	103 (25%)
	A lack of need	18 (4%)	44 (11%)	71 (18%)	84 (21%)	136 (34%)	52 (13%)
	A clear lack of return on investment	19 (5%)	30 (7%)	59 (15%)	82 (20%)	135 (33%)	79 (20%)
	A fear of leaking intellectual property (IP)	18 (4%)	35 (9%)	58 (14%)	77 (19%)	132 (33%)	84 (21%)
	Legal or licensing concerns	18 (4%)	28 (7%)	43 (11%)	93 (23%)	143 (36%)	76 (19%)
	Technology constraints and challenges	23 (6%)	28 (7%)	42 (10%)	105 (26%)	137 (34%)	69 (17%)
	A lack of clear policy or training materials	20 (5%)	32 (8%)	49 (12%)	97 (24%)	135 (33%)	70 (17%)
	A lack of understanding of the value of open standards	21 (5%)	50 (12%)	50 (12%)	66 (16%)	137 (34%)	79 (20%)

Endnotes

1 Busch, 2011. Standards: Recipes for reality, MIT Press.

2 Partnering organizations are active in open source and specification development. For more information about how the survey was fielded, see About this study on page 34.

3 Rosen, Defining Open Standards. Available at www.rosenlaw.com/pdf-files/DefiningOpenStandards.pdf

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6 Krechmer, 2006. Open Standards Requirements. International Journal of IT Standards and Standardization Research Vol. 4(1).

7 https://opensource.org/osd/

8 https://openinventionnetwork.com

9 https://www.ibm.com/blog/open-standards-vs-open-source-explanation/

10 https://www.linuxfoundation.org/projects/standards

11 State of Open Source Report

12 As reflected in the responses to this survey.

13 Contreras, et al. (2022). Preserving the Royalty-Free Standards Ecosystem https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4235647

14 Ghosh, 2011. An Economic Basis for Open Standards, in Opening Standards: The Global Politics of Interoperability Laura DeNardis ed.

15 West, 2006. The economic realities of open standards: Black, white, and many shades of gray, in Standards and Public Policy, Cambridge University Press, Goldstein & Stango eds.

16 Lerner & Schankerman, 2010. The comingled code: Open source and economic development, MIT Press.

17 AOM is a JDF Projects Series LLC. JDF is an affiliate of the Linux Foundation.

18 https://qiskit.org/

19 openquantumsafe.org

20 https://github.com/quil-lang/quil

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