

TheGlobalCTOSurvey. × STXNEXT

SURVEY RESULTS & INSIGHTS

The Global CTO Survey 2023

3rd Edition

HAYS

Working for
your tomorrow

In the realm of the dynamic technology landscape, 2023 heralds a future full of promise for CTOs around the world

Faced with unprecedented challenges, the technology industry has witnessed a remarkable metamorphosis, answering the call for digital acceleration with unwavering determination. Amid these transformative winds of change, the importance of Artificial Intelligence (AI) continues to grow.

As the economic landscape evolves, we set out on a journey to explore the intriguing questions that occupy the minds of CTOs worldwide.

What bold technologies have emerged to transform the modern technology stack?

How did technology leaders protect priceless data and intellectual property?

And most importantly, how are we driving growth for ourselves and our teams amidst the constant evolution of technology?

The 2023 edition of The Global CTO Survey Report serves as a helpful tool, offering insights to technology leaders as they navigate the various opportunities ahead, drawing from the knowledge and experiences of experts worldwide.

The Global CTO Survey Report 2023

With more than 260 esteemed CTOs from around the world contributing their time and invaluable insights, this edition promises to be enlightening and comprehensive. Building on the success of previous surveys, we've expanded the scope of questions, delving into topics such as technological advances, prevailing trends, security challenges, management strategies and more.

Join us to explore the realm of the modern CTO and gain invaluable insight into their roles and responsibilities in shaping the world of technology.

90+

Questions in the survey

From how CTOs got where they are today to technology, leadership, and challenges

260+

Total responses

From CTOs worldwide

6

Continents

Europe, North & South America, Africa, Asia, and Oceania

Thank you to everyone who participated in the survey

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01

Career path

Navigating the CTO
landscape:
Inspiring journeys

BY STX NEXT

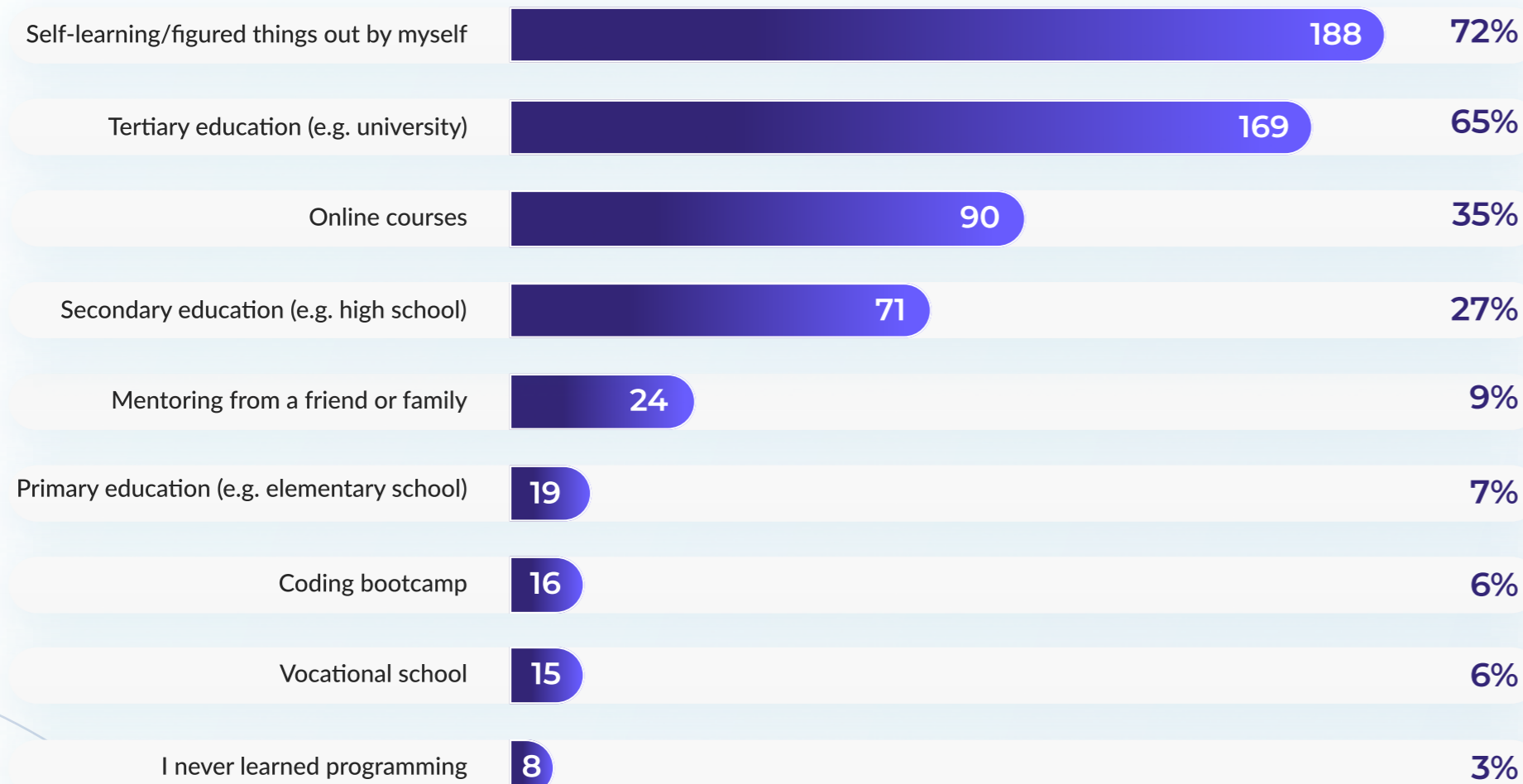
CTOs are often self-learners

Learning on your own requires discipline, and it looks like CTOs have it in spades. Both when it comes to learning programming and learning leadership, CTOs point to learning on their own as the most common path.

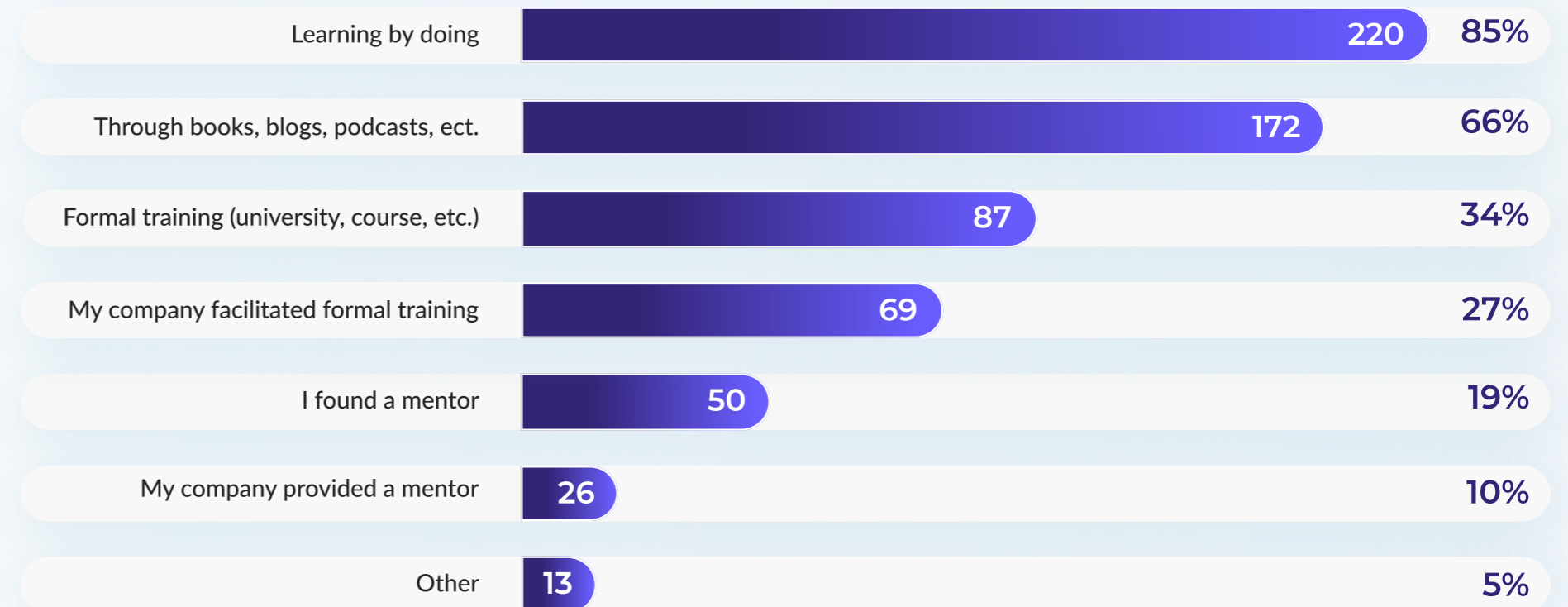
Learning by doing and self-directed learning through books, blogs, newsletters, podcasts, or social media are the most common ways in which CTOs learn leadership. While formal training and mentorship are also reported as ways to learn leadership, they are less commonly reported than the other methods.

How did you learn programming?

Where did you acquire your technical skills?



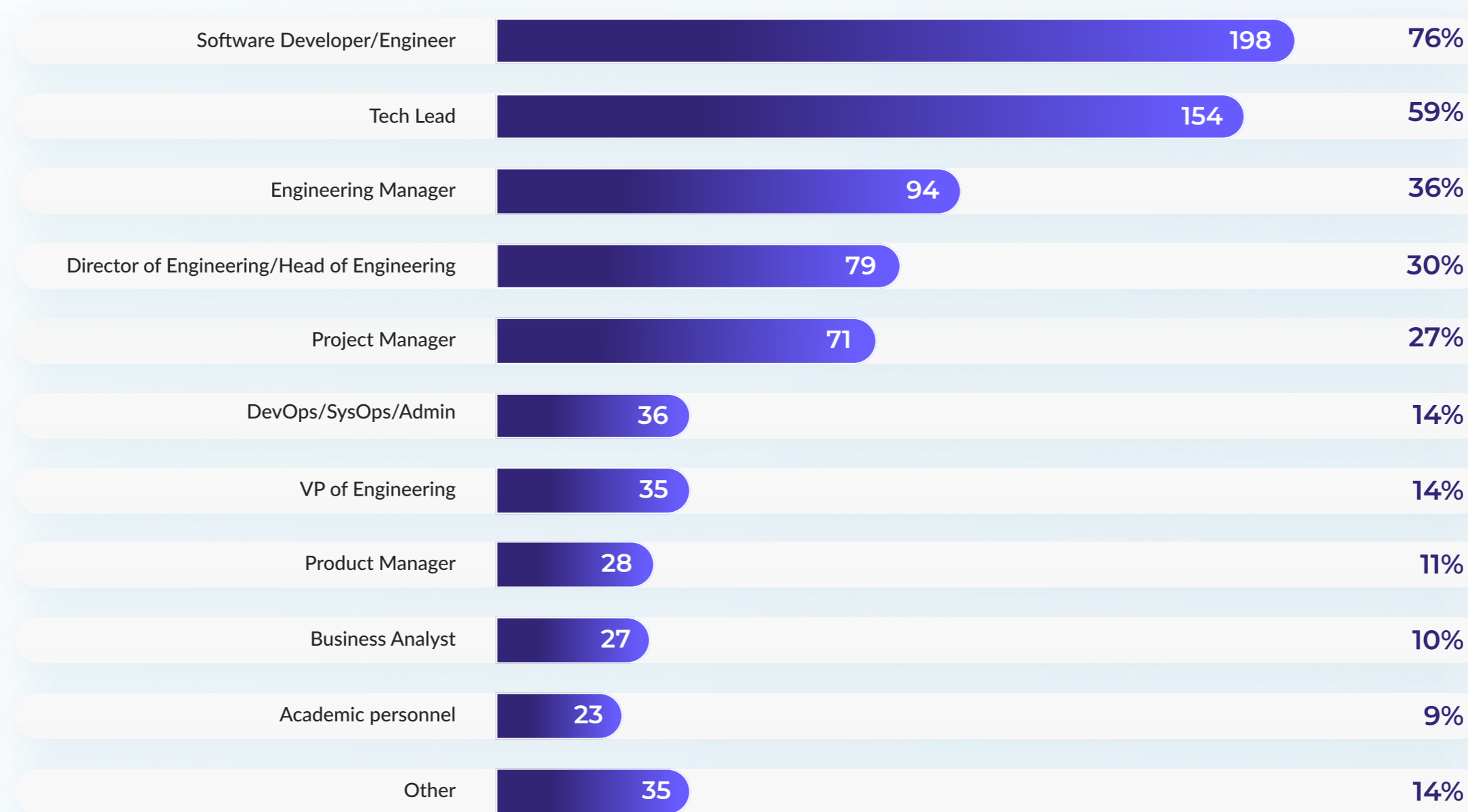
How did you learn leadership?



What kind of experience do CTOs have? (1/2)

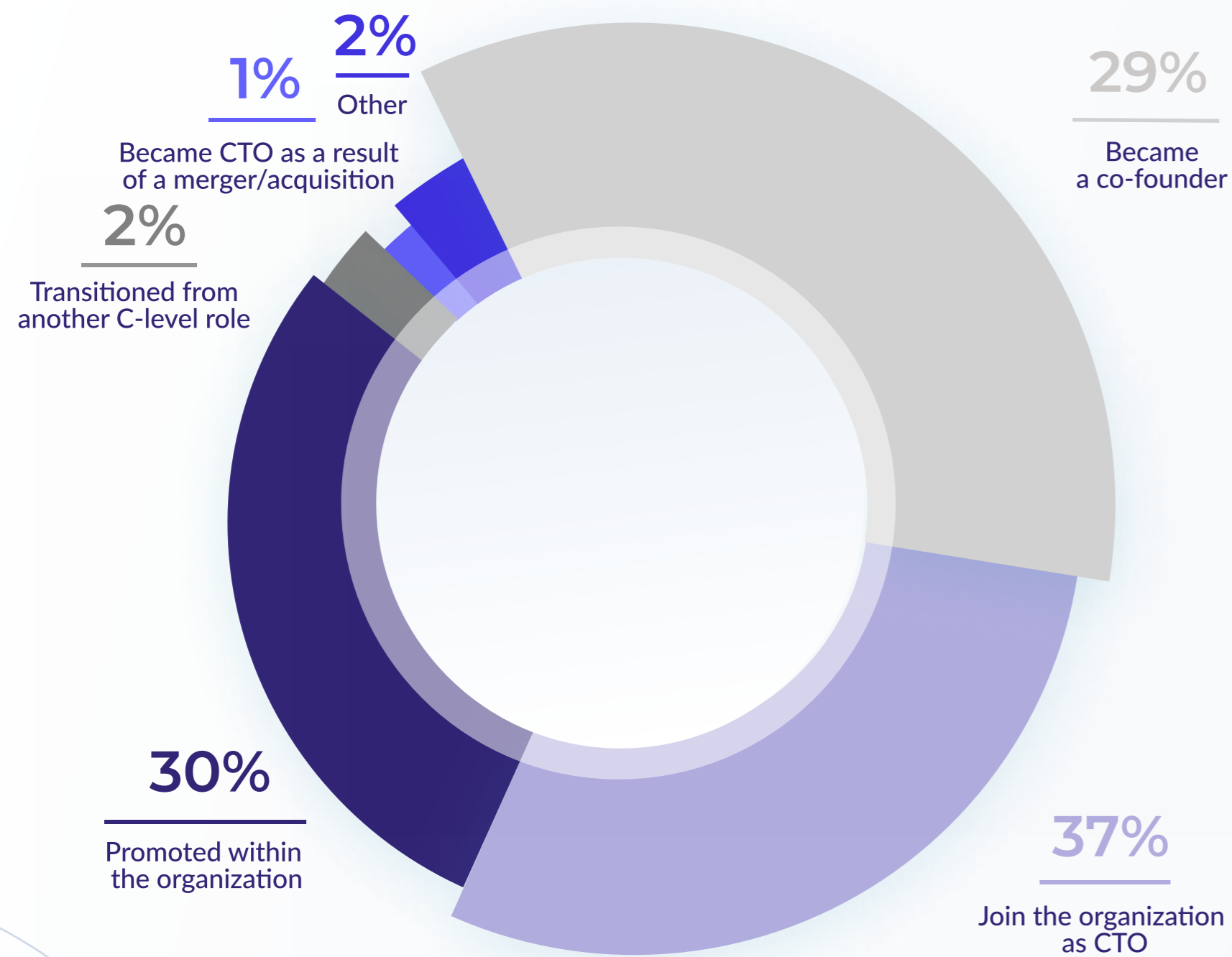
A technical background is a common path to the CTO role, but it's not the only option. While 76% of responders used to be software developers, individuals with a business background can also successfully transition into being a CTO. Regardless of the previous roles, there is no single best way of becoming a CTO. Joining an organization as a CTO, being promoted within an organization, and becoming a co-founder CTO were all popular responses. Becoming a CTO typically takes a significant amount of time and experience. Individuals aspiring to become CTOs should keep this in mind and work towards gaining the necessary experience and skills over a period of years — although not necessarily just as developers.

What were your previous roles?



What kind of experience do CTOs have? (2/2)

How did you become CTO?



From the beginning of your career, how many years did it take you to become a CTO?



Expert commentary

Andrew Weaver

CEO & CO-FOUNDER OF @CTO ACADEMY

The annual CTO survey from STX Next is always an interesting read because it chimes consistently with our experience of "typical career paths and characteristics" though a definition of the CTO role can vary depending on where the business stands in its lifecycle.

Beware the early stage company offering a "CTO role" when the job specification suggests otherwise.

What is definitely a common theme is those who make effective CTOs are highly motivated individuals willing to move out of their comfort zone and test themselves by growing into the hybrid skill set required in senior roles. For many it's not an easy transition because as the survey indicates, the majority of CTOs come from a technical background and are therefore having to travel on a significant journey that includes a fundamental shift in mindset as well as skill set.

Self-learning is integral to the professional growth of technology leaders but also remaining close to a network and community of peers who are available to help and reassure when that career transition can feel overwhelming.



Expert commentary

Arkadiusz Wargin

CEE EXECUTIVE DIRECTOR – IT CONTRACTING AT HAYS

As many as 76% of the CTOs surveyed have previous knowledge of software development and engineering. This doesn't come as a surprise, given that the role requires a mix of practical experience and an understanding of modern technology. Prospective CTOs can acquire such programming skills through readily available education, whether from universities or dedicated training courses.

Our experience at Hays unequivocally shows that the chances of attaining a CTO position without the appropriate technological background are slim, and this is unlikely to change any time soon. While business professionals can transition into being a CTO, a shift into a technical role is necessary early in their career.

However, we're seeing that experts in DevOps and SysOps rarely make this career move, as previous studies shows that the number of CTOs with such work experience remains below 15%. A reason for this might be that DevOps and SysOps experts in senior roles are some of the highest remunerated professionals in tech, and so their motivation to progress to a C-suite role might be slightly lower.

The largest number of surveyed CTOs have acquired their position through a job change, and a further 30% were promoted to this role within their current organisation. However, it's interesting that another 29% of CTOs are co-founders of their companies, confirming that a significant group of individuals seeks opportunities to develop their businesses in the dynamic technological landscape. It may also explain why as many as 49% of CTOs obtained their C-suite role within the first decade of their professional career.



02

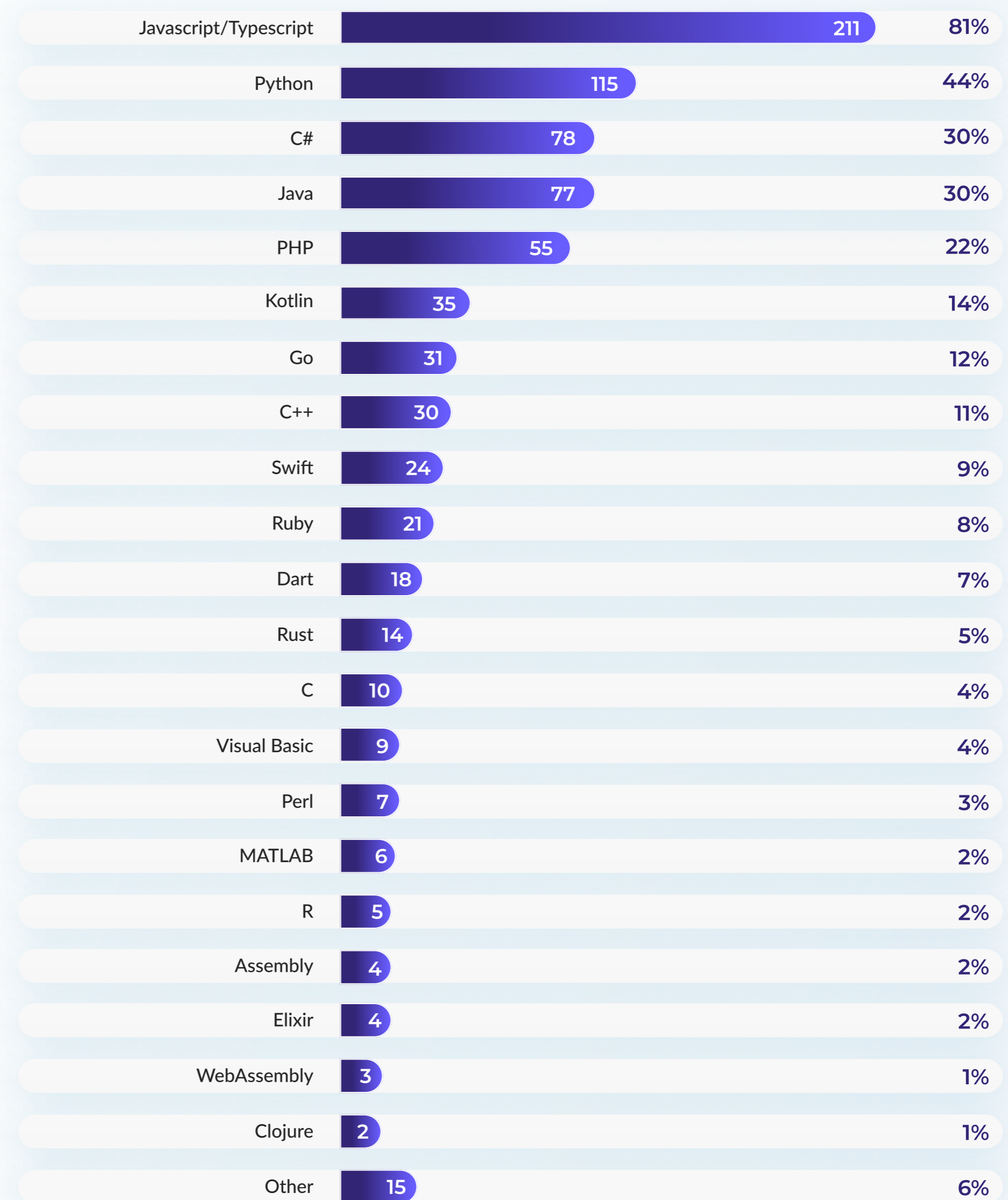
Tech stack

Which programming
languages, frameworks,
and tools are most
commonly in use?

JavaScript/ Typescript are the most popular programming languages among the surveyed CTO teams

Similarly to the previous edition of the CTO Survey, JavaScript (or TypeScript) has claimed 1st in terms of the primary programming languages of CTOs' teams. Once again, over 80% of responders reported it as one of their team's primary languages. Python is in 2nd place, with 44%, while C# and Java are tied for the 3rd spot, with both appearing in 30% of responses. There has been a jump in the popularity of C#, which has moved from 5th place in the 2021 survey to 3rd place in this year's survey. Also observed was a drop in the popularity of the PHP language from 3rd to 5th place compared to the previous CTO Survey.

What are your teams' primary programming languages?



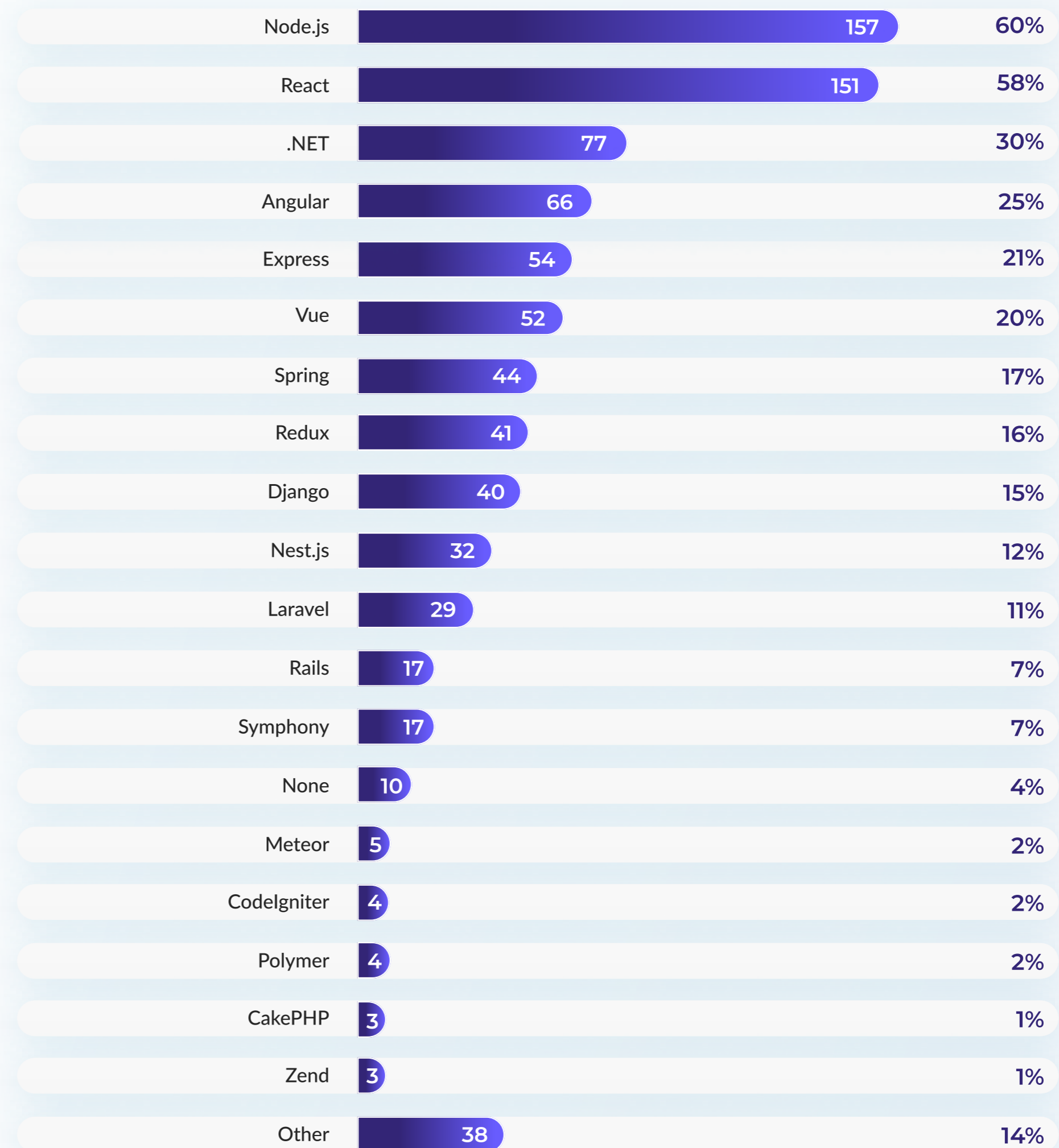
JavaScript technologies dominate the list of most popular programming tools

The results highlight the prominent usage of Node.js, React, .NET, Angular, Express, and Vue as the primary programming tools employed by the teams of the surveyed CTOs.

That said, it's Node.js that holds the highest adoption rate among the teams. Given that Node.js is a runtime environment for JavaScript, the most popular language in the survey, its place as number one is hardly surprising. React, a JavaScript library for creating SPAs and mobile apps is a close second on the list.

Interestingly, in the previous edition of the survey, these two answers were flipped, with React coming in first, and Node.js second.

What programming frameworks do your teams use?



Expert commentary

Paweł Kulpa

HEAD OF JS AT STX NEXT

JavaScript once again, firmly confirms its versatility by being the most popular language in the current CTO Survey. The noticeable rise in popularity of Node.js on the backend and the stabilized positions of the top three frontend frameworks (React, Vue, Angular) show that we have a real full-stack JavaScript force that will be hard to stop. Undoubtedly, JavaScript will continue to play a decisive role in shaping the digital world. With great interest, I'm excited to see how AI boosters support the work of JavaScript developers by increasing their efficiency and productivity. Still, I'm even more curious to see not what but when the next JS superpower will show up in AI's transformation.



Expert commentary

Marcin Zabawa

DIRECTOR OF DELIVERY EMEA AT STX NEXT

Python is the second most popular language according to CTOs, yet its web frameworks (i.e. Django, Flask, etc.) are less frequently used than leading frameworks from other languages (Spring for Java, .NET for C#). That reveals a versatile aspect of Python, which is often used not only for web development but also for data processing, ETL, API integrations, scripts, and of course Artificial Intelligence.

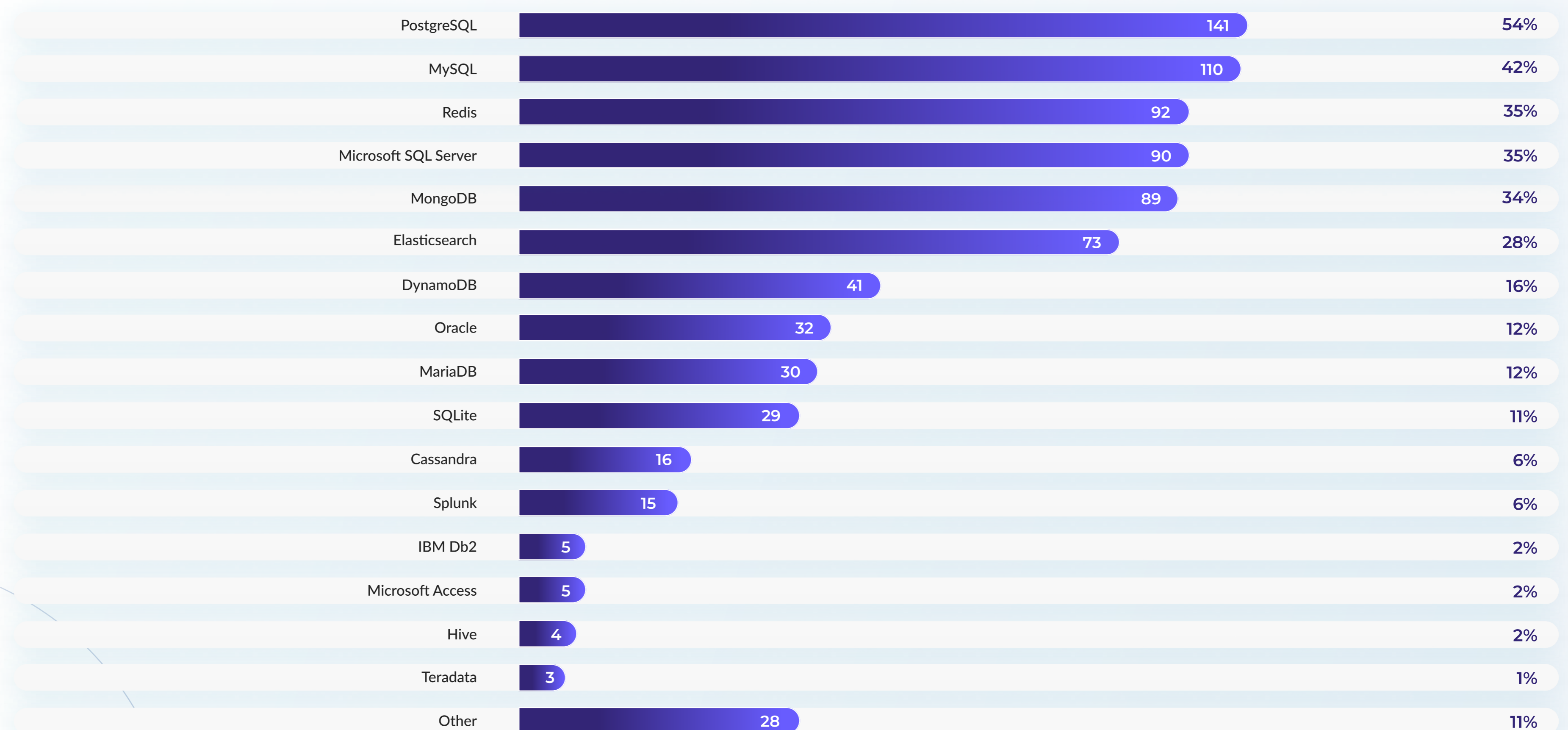
A bit of a surprise might be the continuing popularity of Angular. Many CTOs decide to stick with it regardless of many developers' preference to switch to React. The outcome is a shortage of Angular developers, as new JS programmers joining the workforce are choosing React as their main framework.



PostgreSQL and MySQL are the most often used databases

Over half of responders said their teams use PostgreSQL, thus making it the most popular answer. MySQL is not far behind, with 42%. Redis, Microsoft SQL Server, and MongoDB close out the top 5, with not much difference in popularity between the three. Redis and Microsoft SQL Server were both used by the teams of 35% of our CTOs, and MongoDB by 34%. Interestingly, 11% of CTOs are using other databases not listed in the survey.

What databases do your teams use?

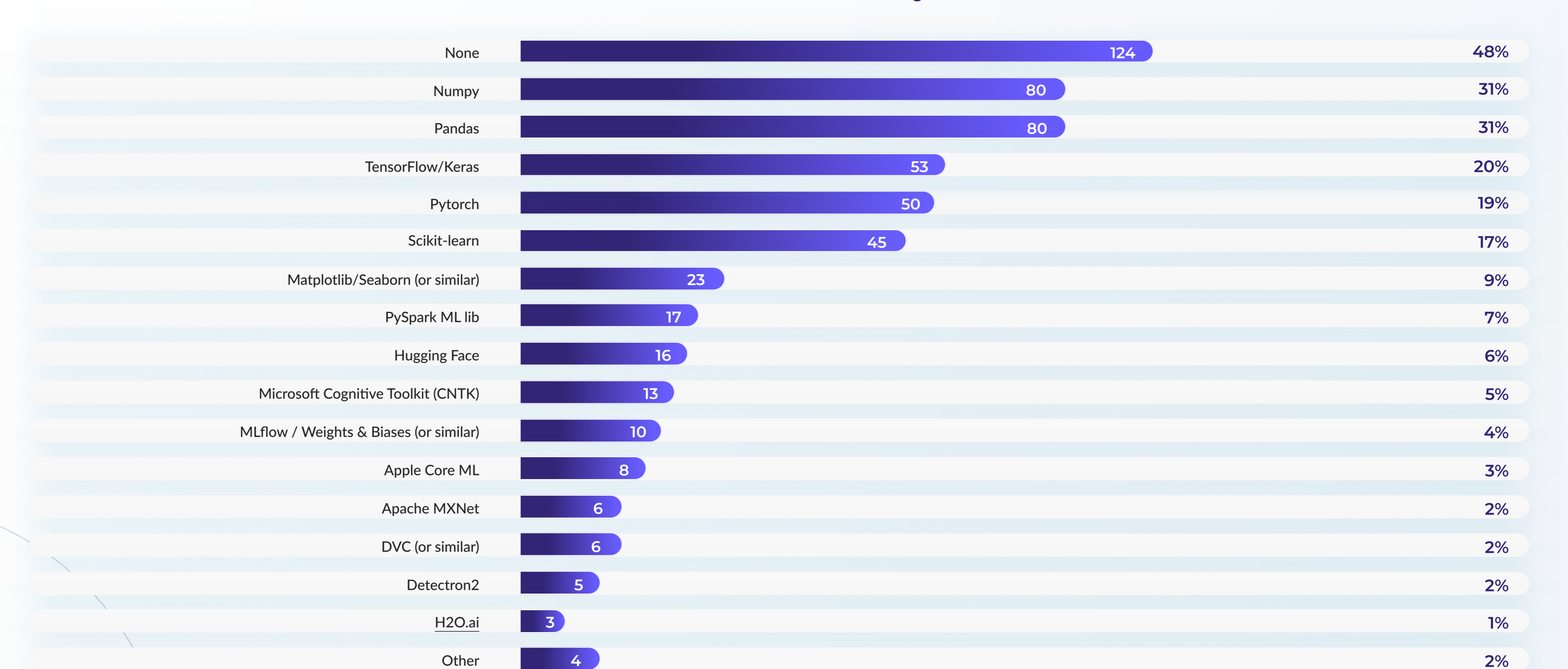


48% of surveyed CTOs don't use any Data Science frameworks

Python is the go-to language in Data Science, which is reflected in the five most popular data science frameworks mentioned in the survey responses. These frameworks — Numpy, Pandas, TensorFlow/Keras, PyTorch, and Scikit-learn — all leverage Python's powerful features.

That said, almost half of the surveyed CTOs don't use any Data Science frameworks. What is more, the result was almost identical in the previous edition of the survey.

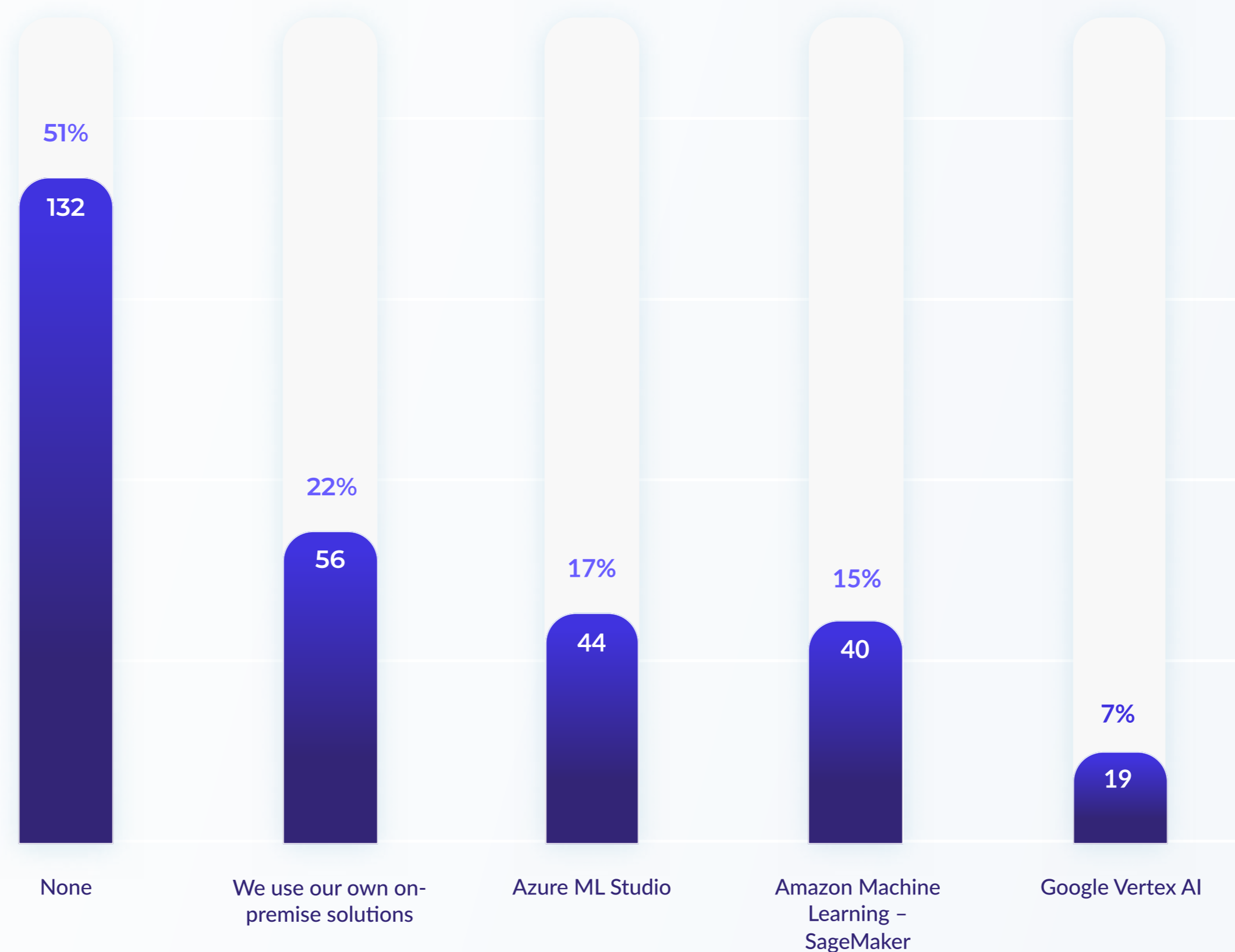
What Data Science frameworks do your teams use?



Many teams do not utilize ML in the Cloud

Most of the surveyed teams either do not use a dedicated Machine Learning Cloud solution or have chosen to rely on on-premise solutions. However, out of those teams that do use Machine Learning Cloud solutions, Azure ML Studio and Amazon Machine Learning/SageMaker emerge as the more popular choices. They were mentioned by 17% and 15% of CTOs, respectively.

Which Machine Learning Cloud solution do you use?



Expert commentary

Marcin Zabawa

DIRECTOR OF DELIVERY EMEA AT STX NEXT

Already 39% of surveyed CTOs declare they utilise ML in the Cloud. My prediction is that this number will only grow in the next years, taking primacy over on-premise, in-house-built ML solutions. Azure will probably stay the most popular option and Amazon might be in danger of losing its second position to Google due to being late to the race in both AI software and AI hardware.

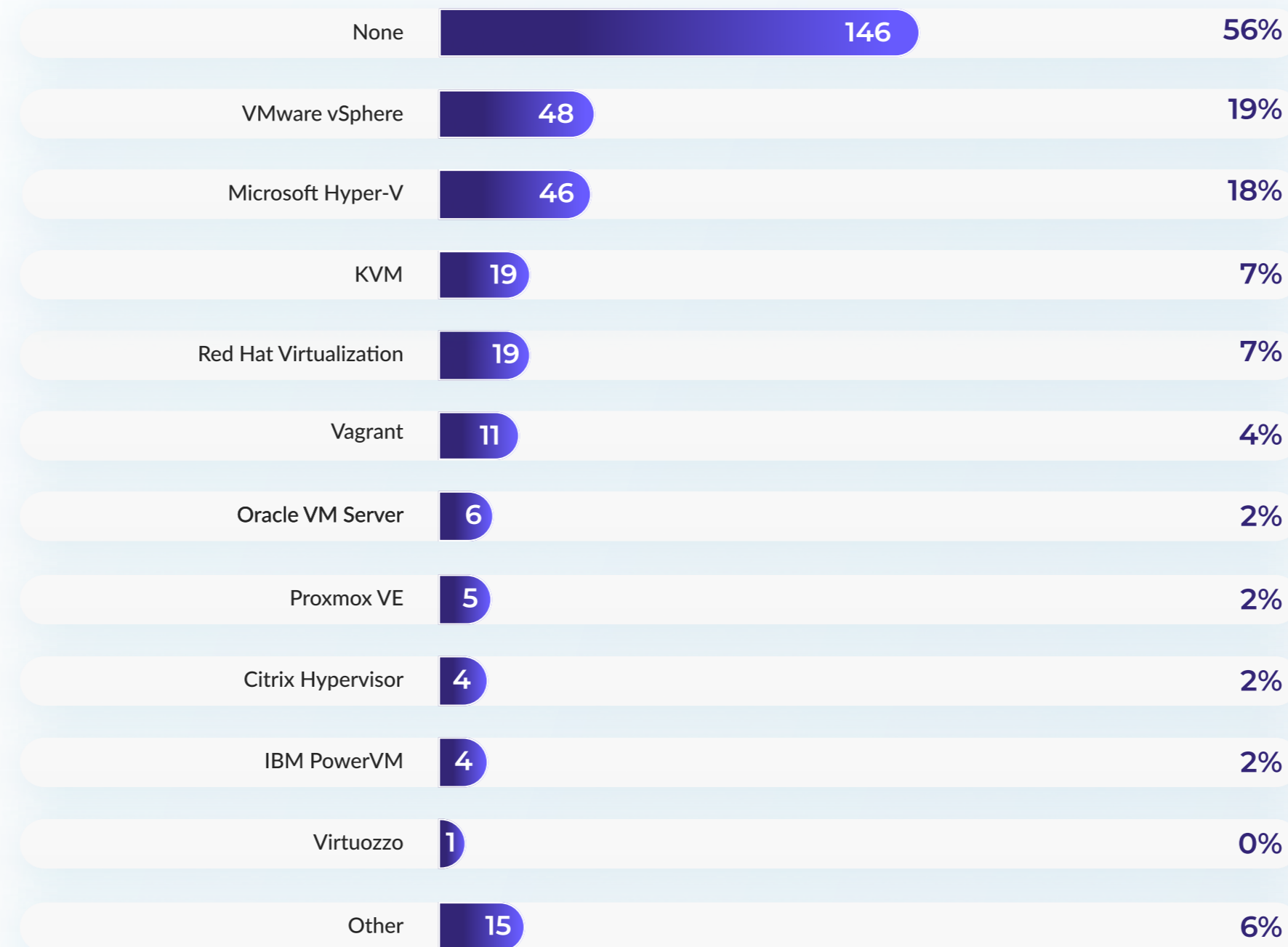


Server virtualization software is not popular among surveyed CTOs

While the majority of the CTOs reported not using any specific server virtualization software, VMware vSphere and Microsoft Hyper-V emerged as the notable choices among the surveyed teams that utilize this technology.

When it comes to containerization tools, Docker leaves the competition in the dust, as 83% of surveyed CTOs mention it's being used by their teams.

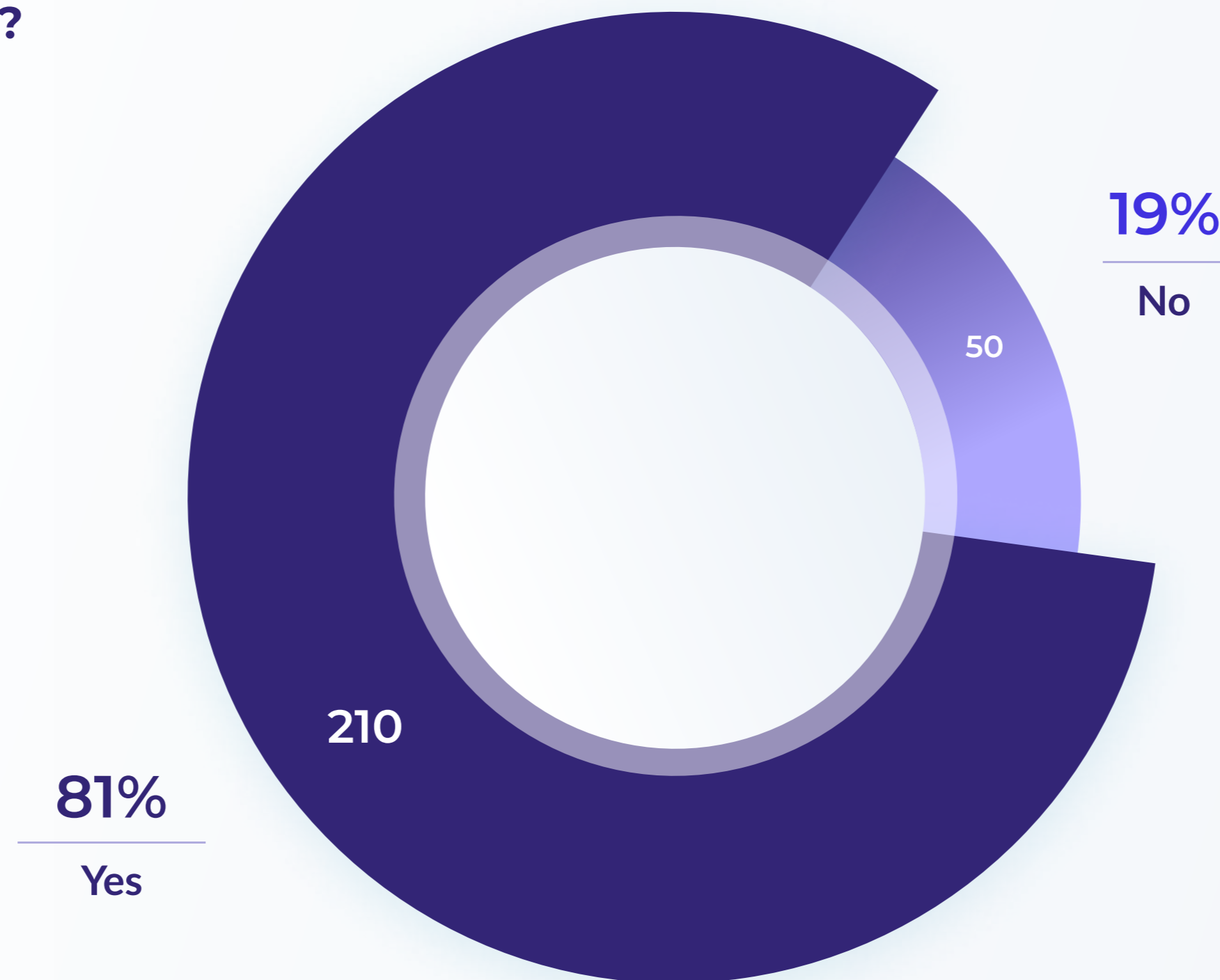
What server virtualization software do your teams use?



Actively developing Cloud-Native technologies is the norm

81% of the respondents reported that they are currently developing Cloud-Native technologies. This indicates a strong adoption and focus on Cloud-Native architecture and development practices within the organizations of these CTOs. Such a high percentage of organizations developing Cloud-Native technologies suggests that they are recognizing the benefits of Cloud Computing and are taking advantage of the Cloud's capabilities.

Is your organization currently developing Cloud-Native technologies?



03

Trends and technologies

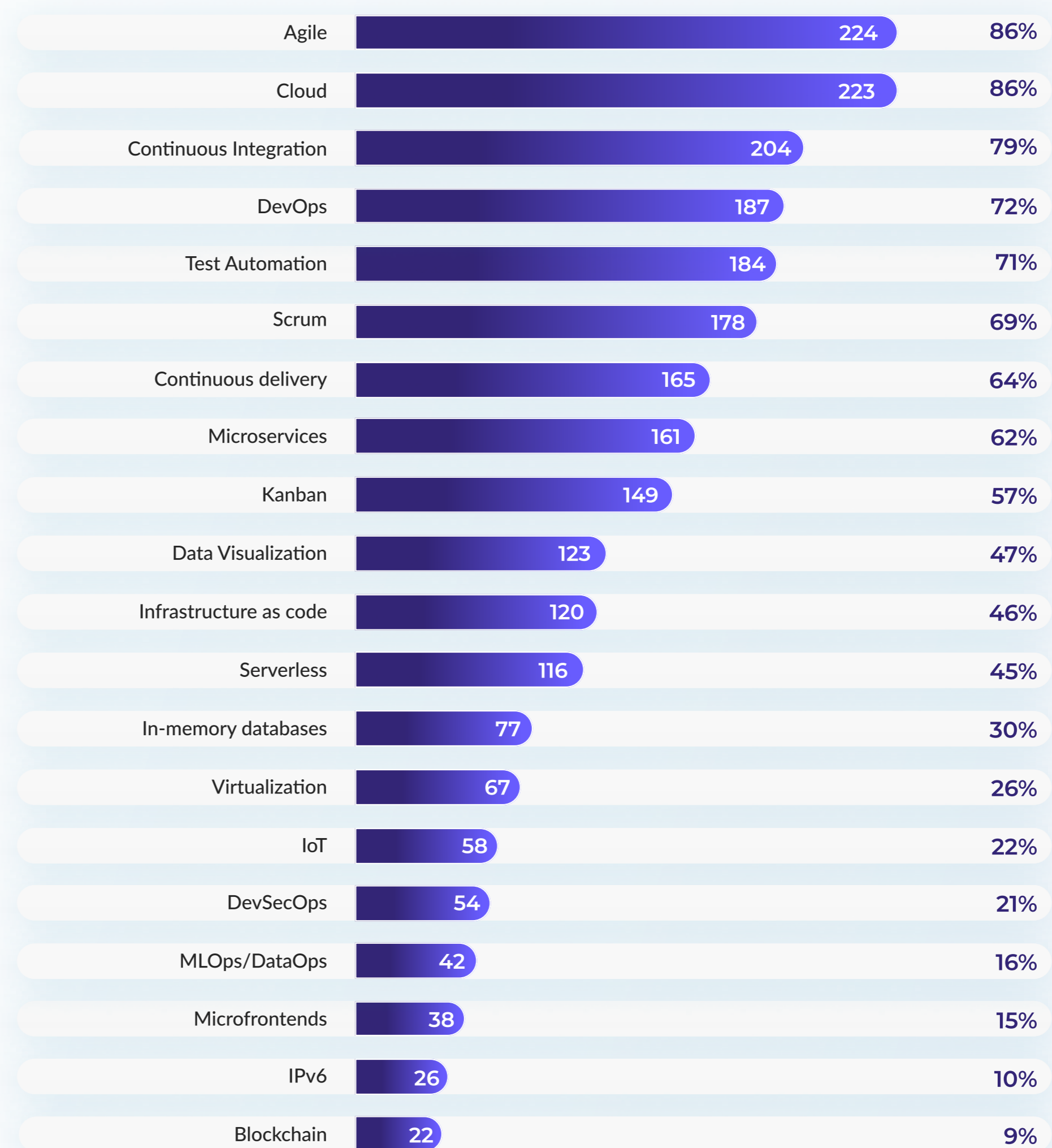
Navigating the tech horizons:
Emerging trends for CTOs

BY STX NEXT

Agile and Cloud dominate the “most popular trends” list

According to the answers, Agile and Cloud technologies are the most widely adopted trends – both answers were marked by 86% of the CTOs. Other commonly implemented trends include Continuous Integration (79%), DevOps (72%), and Test Automation (71%). Meanwhile, some emerging technologies like IoT and Blockchain still have lower implementation rates – they were mentioned by 22% and 9% of responders, respectively.

Which of the following have you implemented?

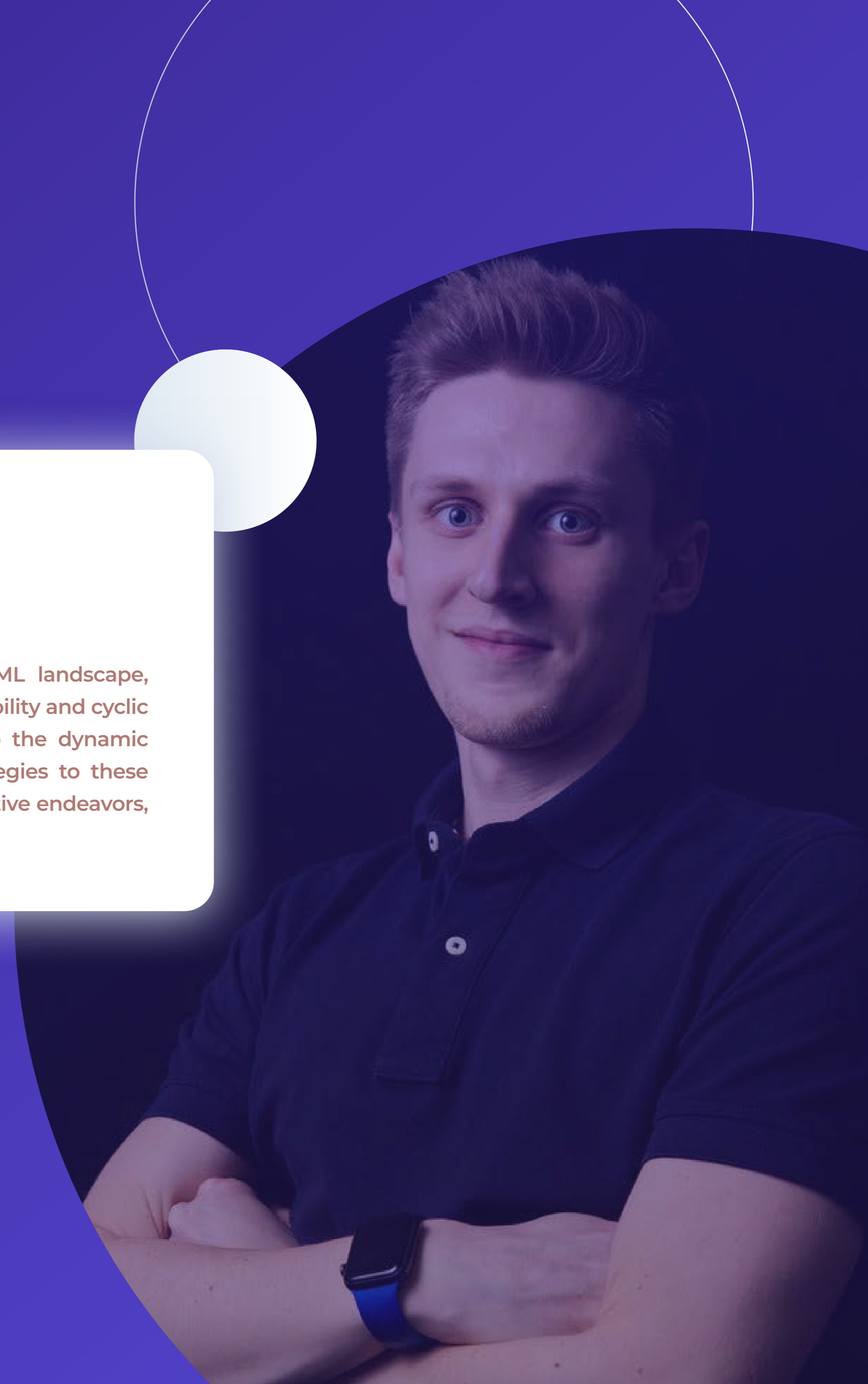


Expert commentary

Damian Winczewski

HEAD OF AGILE AT STX NEXT

Agile methodologies have emerged as a beacon in the AI and ML landscape, especially given the rapid evolution of these technologies. The adaptability and cyclic progression inherent in Agile approaches are particularly suited to the dynamic nature of AI and ML projects. By refining and tailoring Agile strategies to these specific domains, businesses can ensure cyclic evolution, foster collective endeavors, and maintain resilience to shifting paradigms.



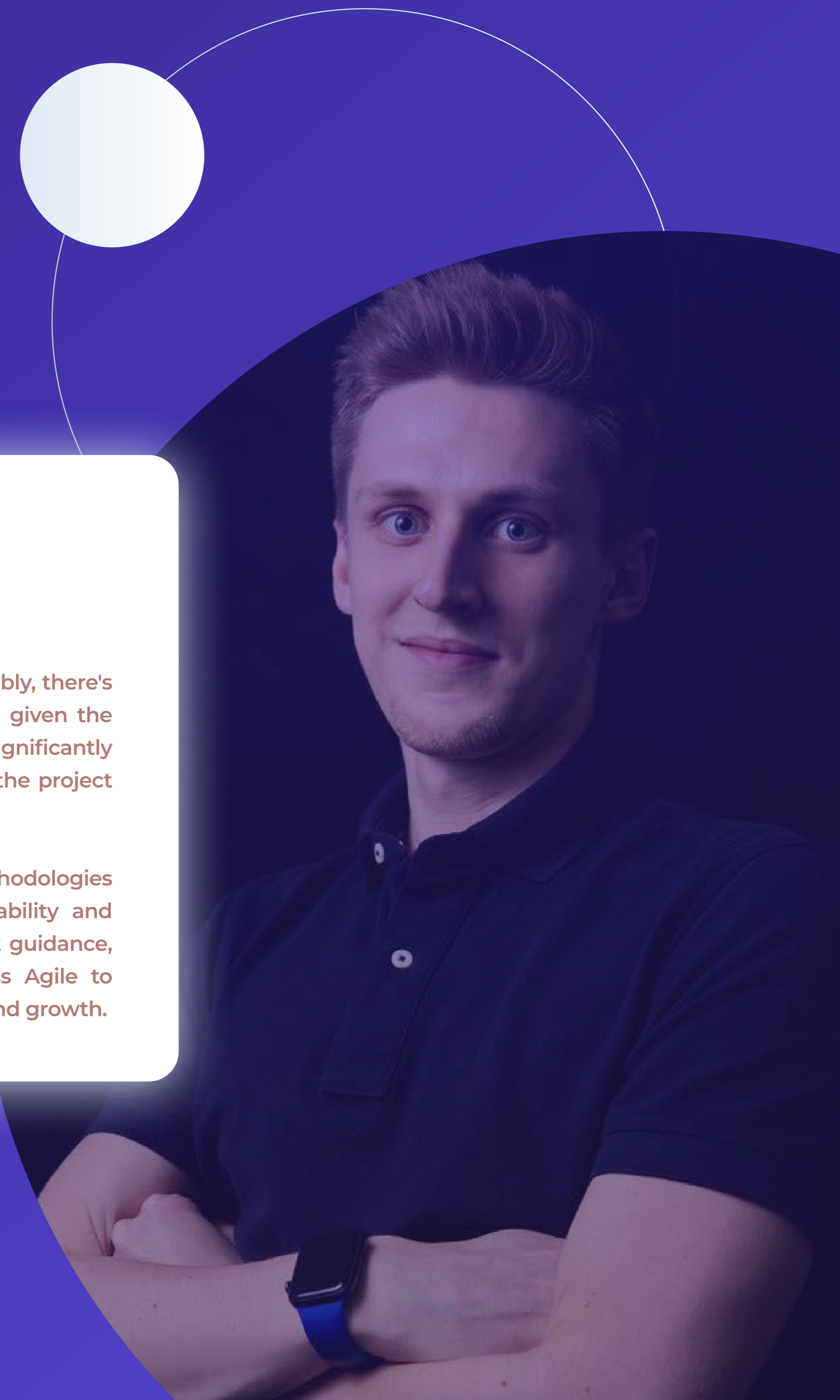
Expert commentary

Damian Winczewski

HEAD OF AGILE AT STX NEXT

Incorporating Agile into AI and ML projects offers many advantages. Notably, there's the swift adaptation to an ever-evolving digital sphere, which is crucial given the pace of AI and ML advancements. Additionally, Agile methodologies can significantly diminish risks, ensure fiscal prudence, and enhance both the caliber of the project and overall customer contentment.

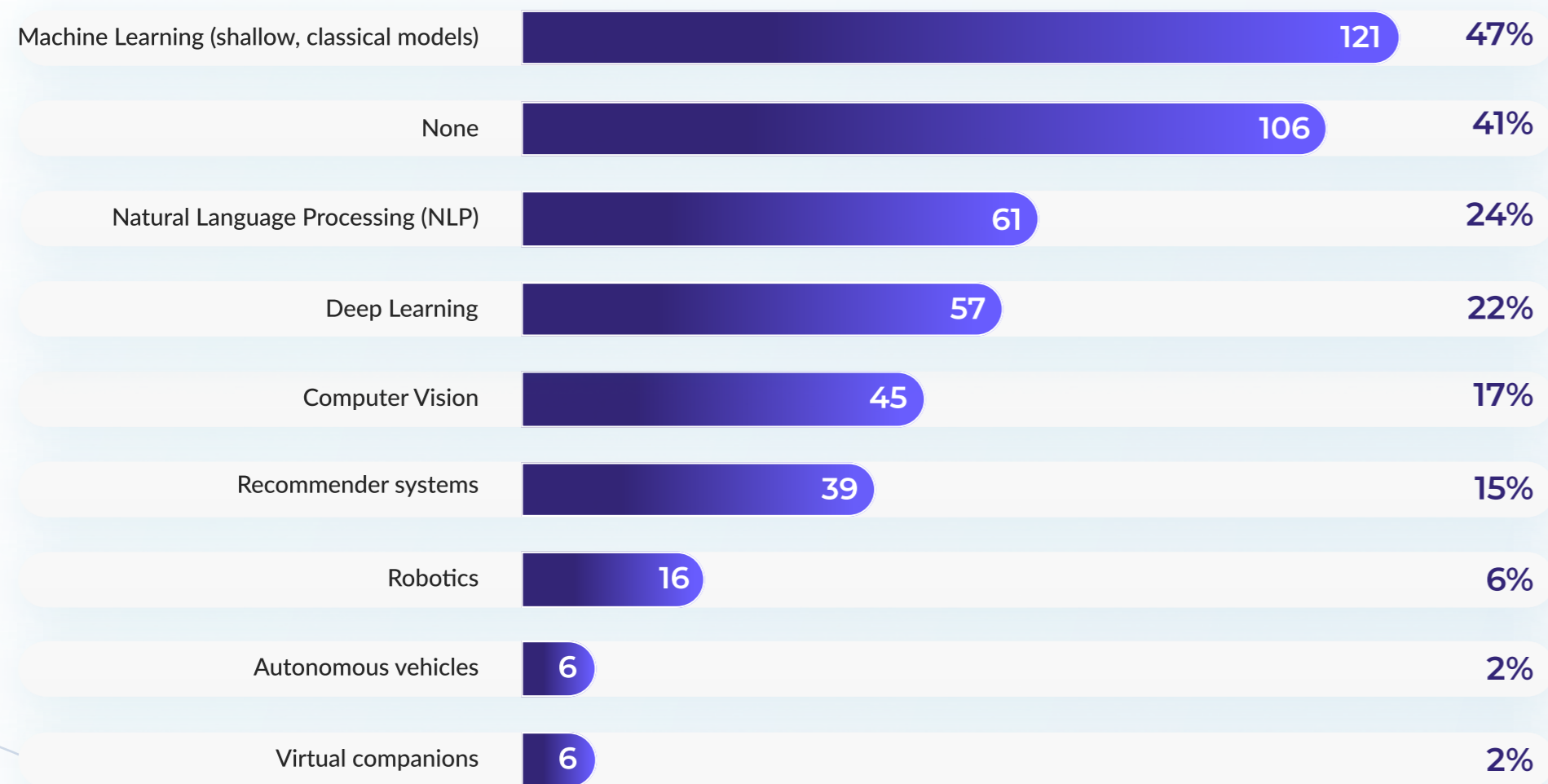
As AI and ML continue on their upward trajectory, the importance of methodologies like Agile will only grow. The future will demand even more adaptability and collaboration, and Agile is poised to meet these challenges. With expert guidance, such as from the Agile Center of Excellence, businesses can harness Agile to navigate the complexities of AI and ML, ensuring continuous innovation and growth.



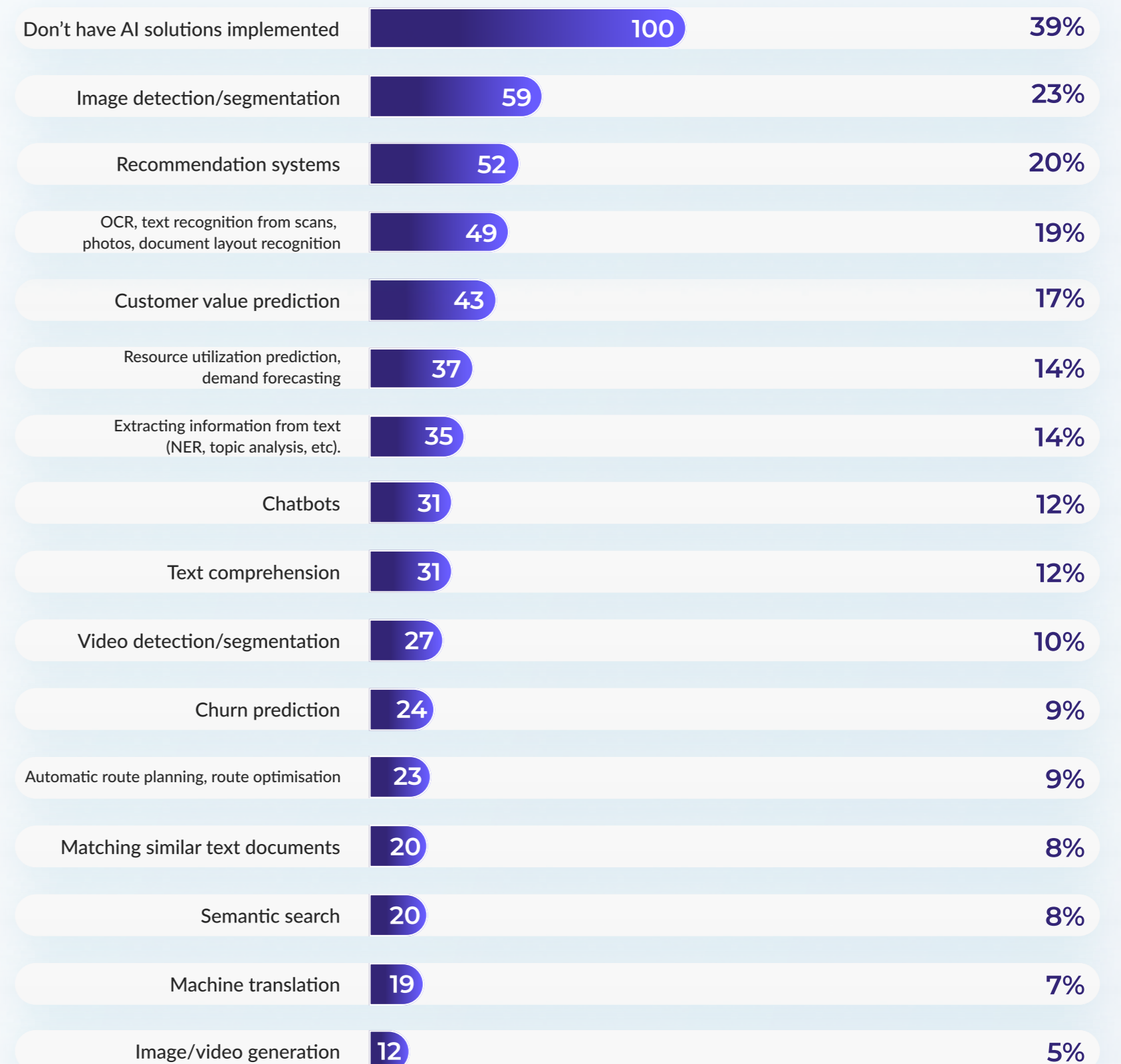
Are CTOs implementing AI technologies?

Machine Learning is the most commonly implemented AI technology among the surveyed CTOs, with 47% of them indicating they use it. However, it is noteworthy that as much as 41% of the respondents reported that they have implemented no AI technologies. Similarly, 39% of surveyed CTOs said they do not have any AI solutions implemented. Among the classes of problems that have been addressed with AI solutions, image detection/segmentation is the most popular, followed by recommendation systems and OCR/text recognition.

Which AI technologies have you implemented?



Which classes of problems does your AI solution fall into?



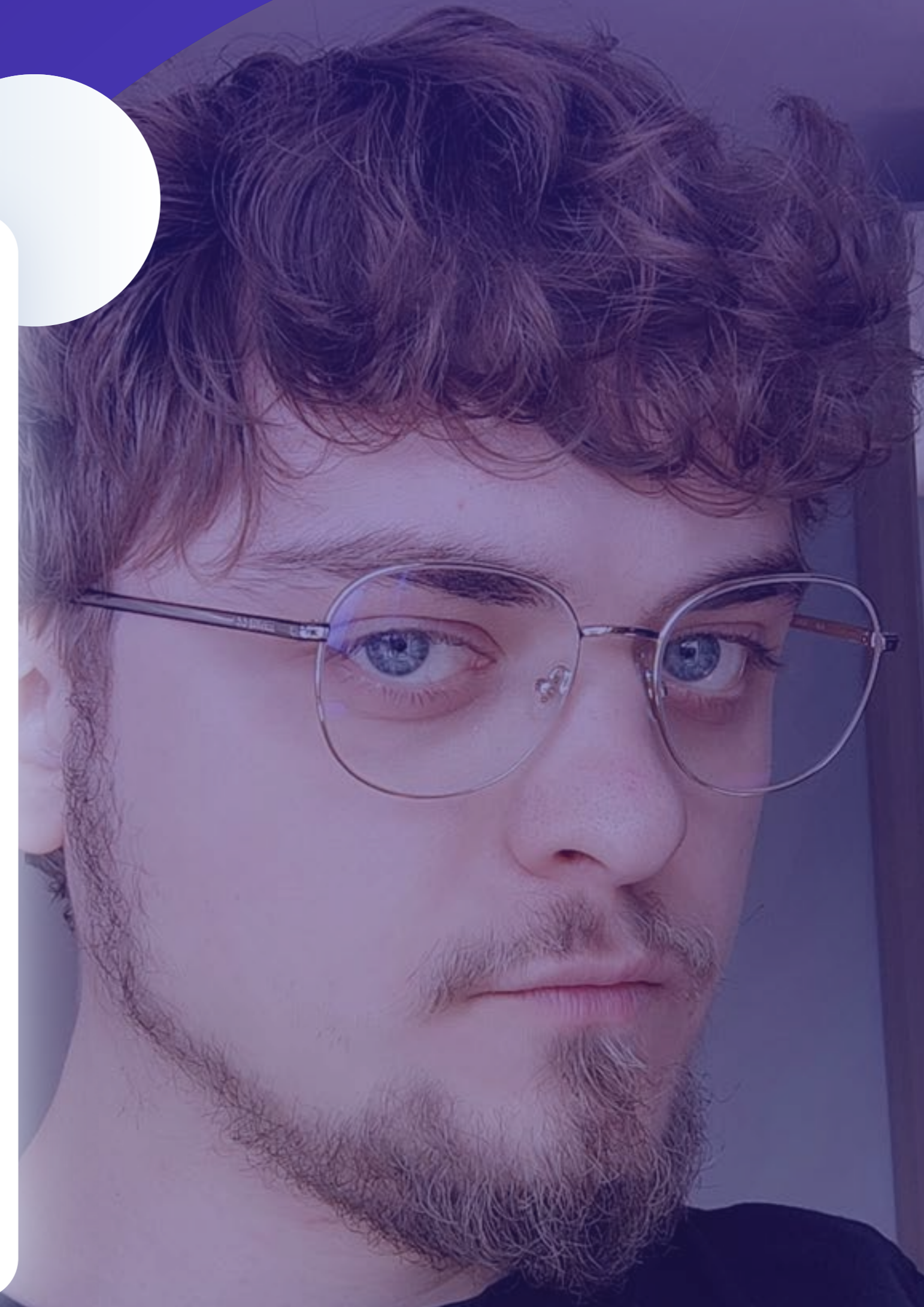
Expert commentary

Szymon Idziniak

MACHINE LEARNING ENGINEER AT STX NEXT

The chart shows that most Machine Learning (ML) models are classic and simple models such as XGBoost. This trend can be attributed to the prevalence of tabular data from various applications and sources. Machine Learning is fundamentally focused on data, not models, and our approach prioritizes adapting the solution to the data, not the other way around. As a result, there is relatively less interest in Deep Learning, including areas such as Natural Language Processing (NLP) and Computer Vision (CV), mainly due to the limited availability of data. In most cases, simple models are sufficient without delving into Deep Learning and Neural Networks.

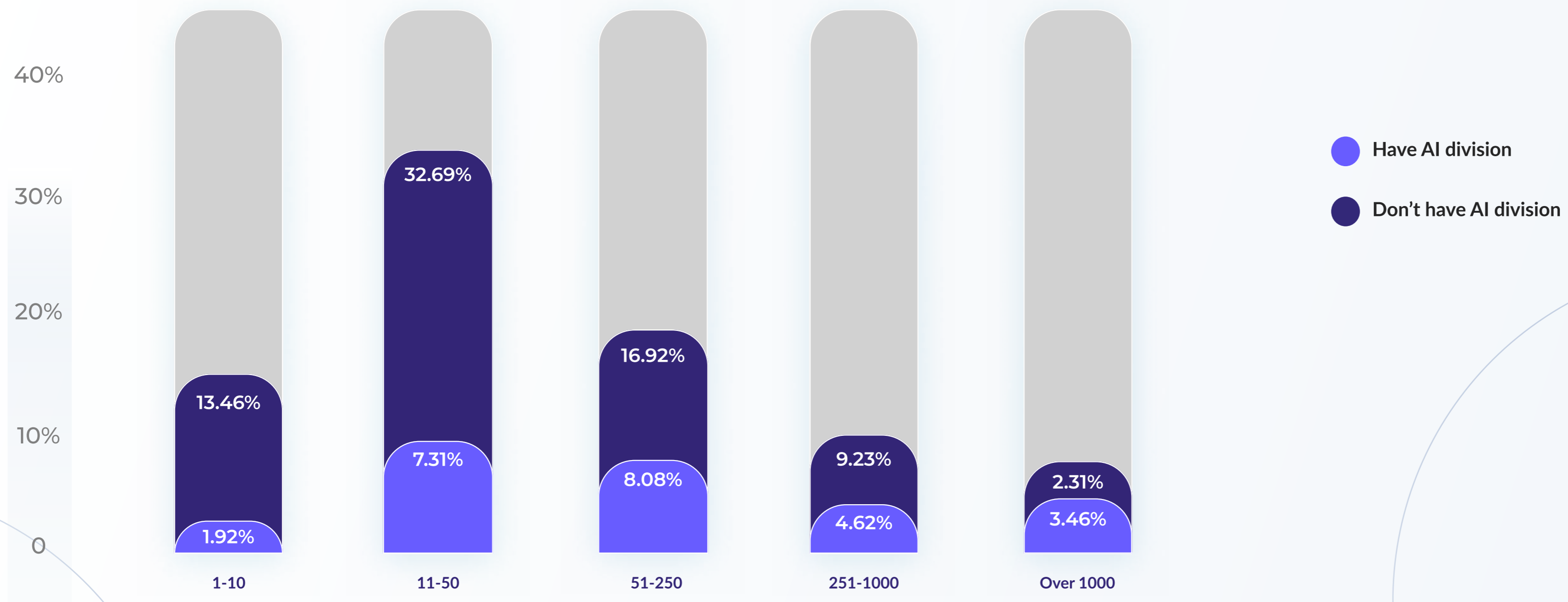
Moreover, there has been significant growth in NLP, driven by the emergence of open-source NLP models and Large Language Models (LLMs). LLMs are used in a zero-shot format, eliminating the need for intensive fine-tuning. Instead, providing appropriate textual context enables the creation of intelligent chatbots, such as the Retrieval-Augmented Generation (RAG) model. This development offers exciting possibilities, enabling more efficient use of pre-trained models, and reducing the time and resources required to train custom models.



Company size matters: AI team presence insights

The analysis of company size and its impact on the presence of dedicated AI teams reveals intriguing insights. It is essential to consider that the number of responses from large companies is fewer compared to smaller enterprises. Consequently, the overall count of AI teams appears lower. However, when we analyze this in terms of percentages, a significant trend emerges. Larger companies exhibit a substantially higher likelihood of having dedicated AI teams compared to their smaller counterparts.

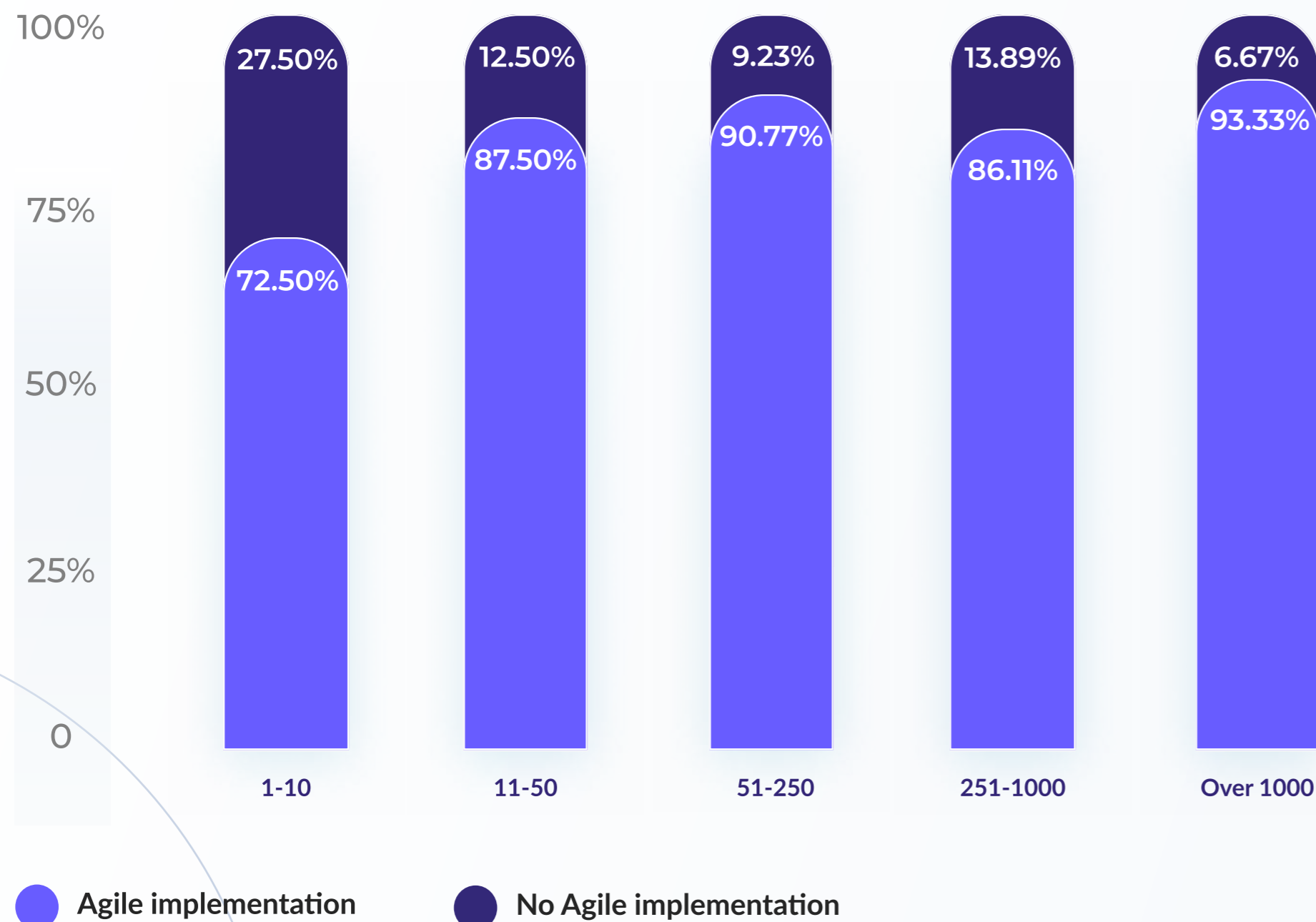
Company size vs AI implementation



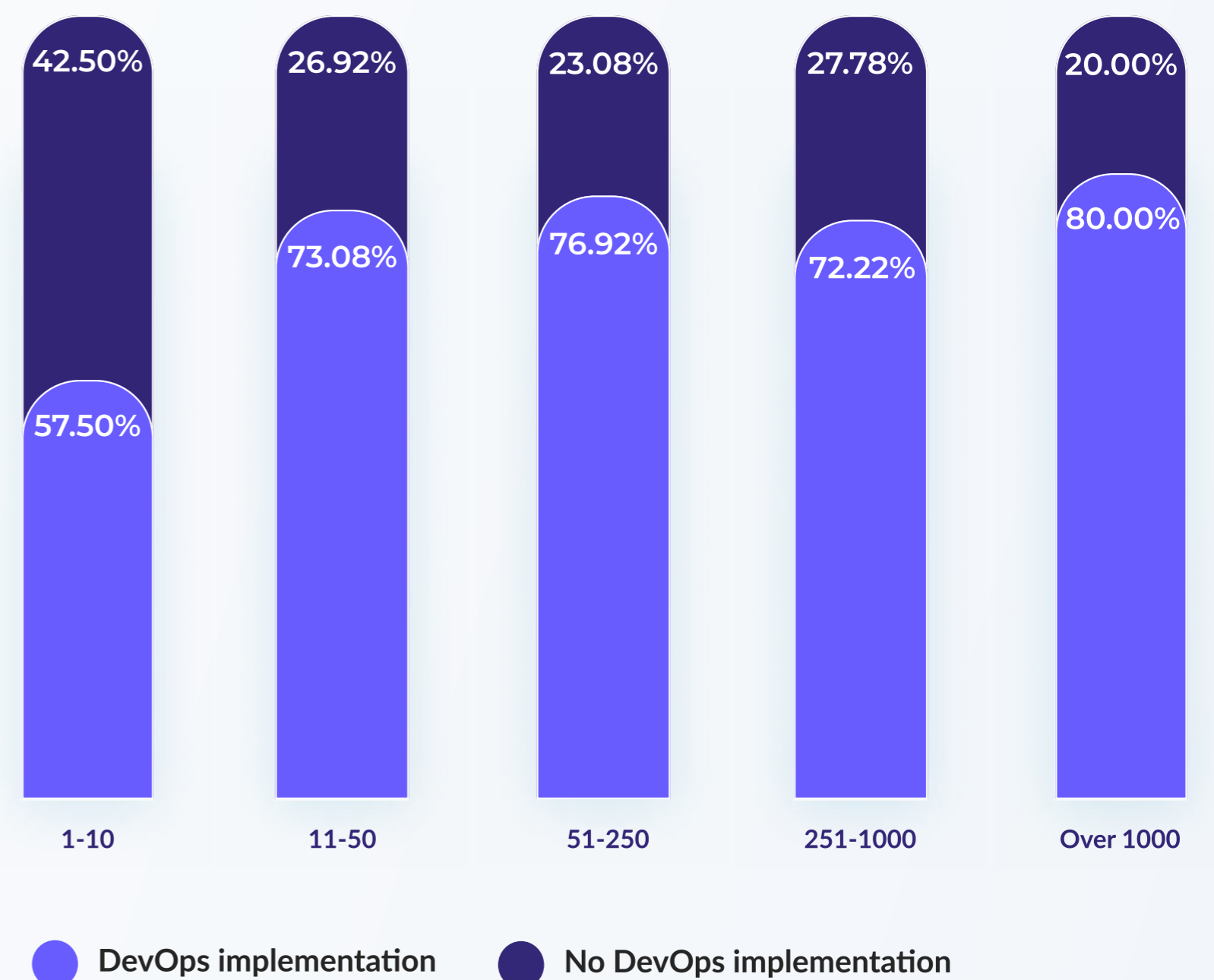
Companies of all sizes widely adopt Agile and DevOps methodologies

The relationship between company size and the implementation of Agile and DevOps practices paints an illuminating picture. It's worth noting that there is a discernible pattern suggesting that the adoption of these methodologies is not uniform across companies of varying sizes. Instead, there appears to be a clear inclination towards greater adoption in larger corporations. Irrespective of company size, there is a widespread enthusiasm for Agile, with adoption rates ranging from 72.50% to 93.33%. This suggests the universal appeal of Agile methodologies. Interestingly, smaller organizations (1-10 employees) stand out with significant adoption rates, showcasing a proactive approach to embracing Agile practices. The story is much the same for DevOps, with adoption rates spanning from 57.50% to 80%, demonstrating its global acceptance.

Company size vs Agile



Company size vs DevOps implementation



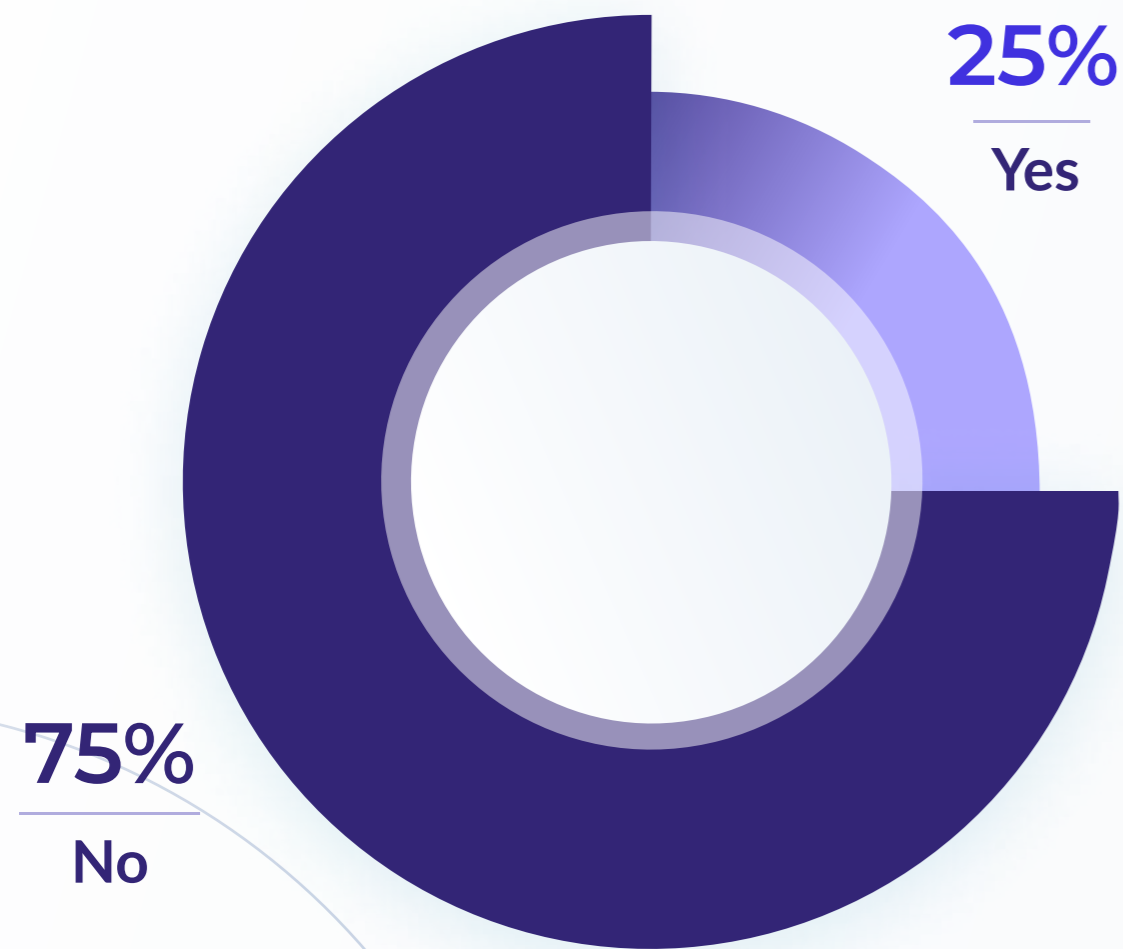
How much AI talent is there in the companies of the surveyed CTOs?

Out of the surveyed CTOs, 25% reported having a separate AI or data division in their companies, while the majority, 75%, indicated not having a dedicated division for AI or data.

50% of CTOs reported having no team members in dedicated AI, ML, or data science roles, and 38% said they had between 1 and 5 such team members.

61.4% of CTOs also reported not actively hiring AI talents at the moment, while 24.8% admitted to facing difficulties when hiring AI talents for their organizations.

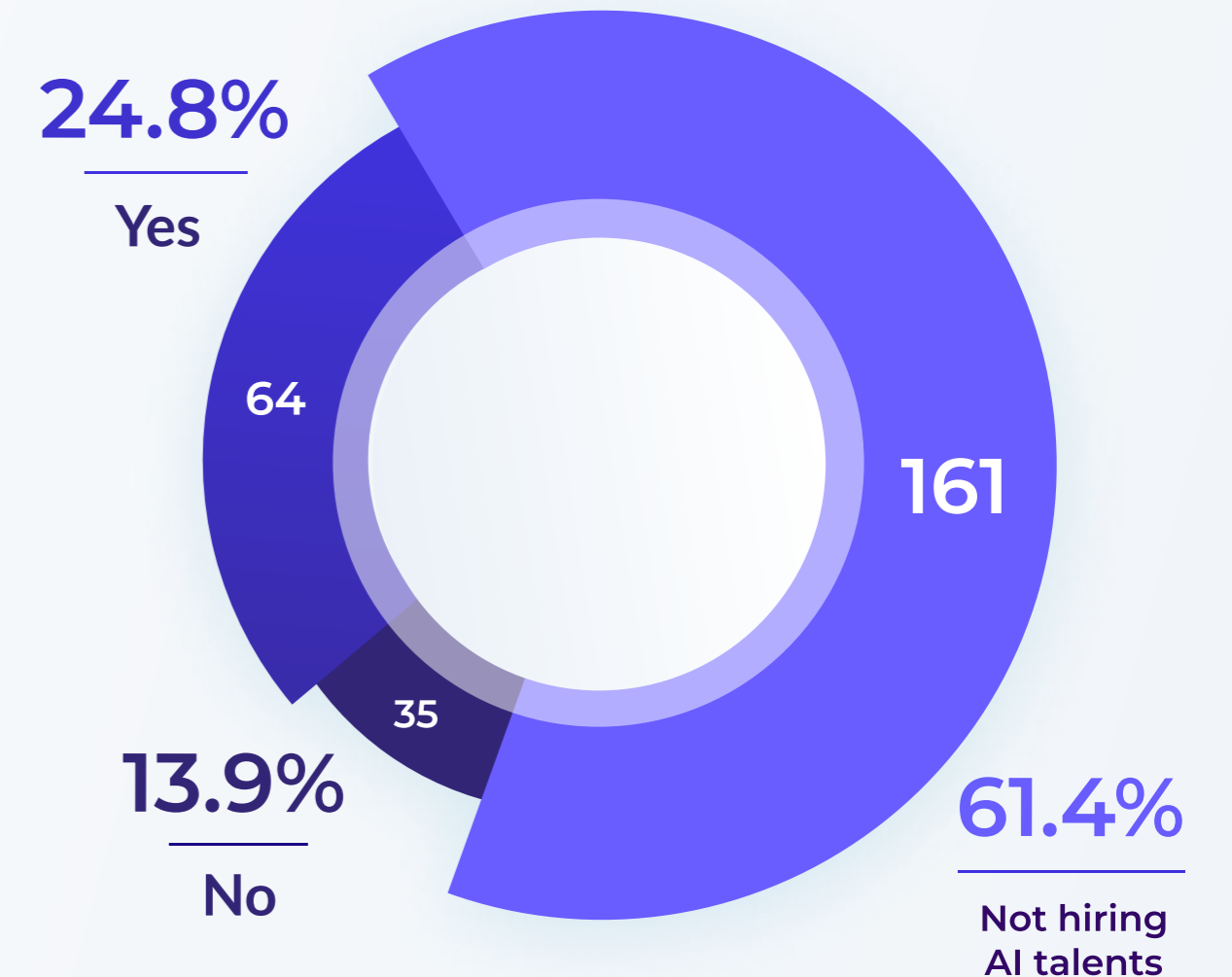
Do you have a separate AI/Data division?



How many team members do you have in a dedicated AI/ML/Data Science role?



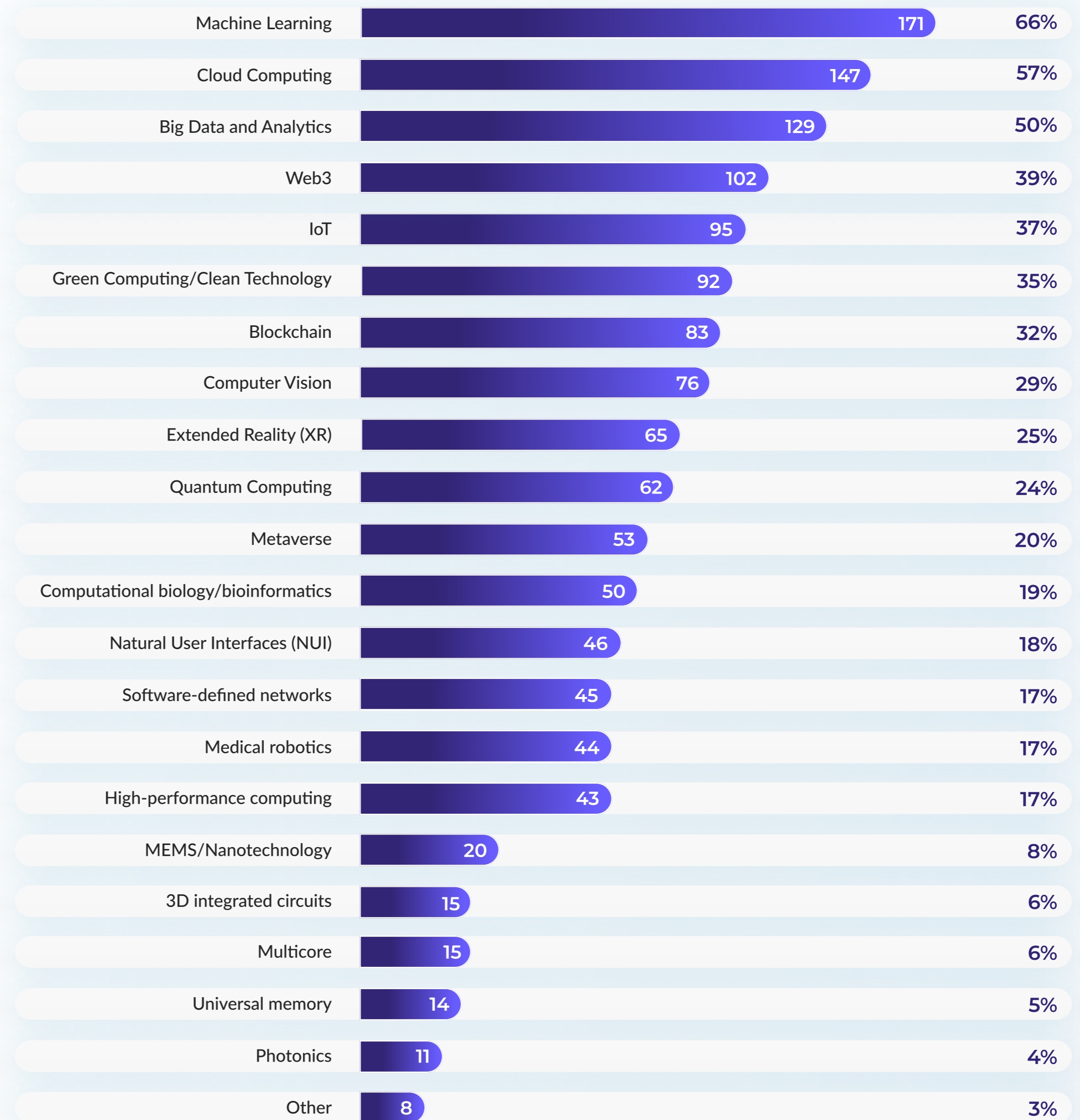
Do you face difficulties when hiring AI talents for your organization?



CTOs bet on Machine Learning

Machine Learning is already the most implemented AI technology among the responders, and they believe its popularity will continue to grow in the next 2-4 years. 66% of the CTOs made that prediction. Cloud Computing and Big Data and Analytics were also popular choices for technologies that will become more prominent – they appeared among 57% and 50% of responses, respectively. Meanwhile, 3D integrated circuits, multicore, universal memory, and photonics were the least common choices.

Which technologies and trends do you think will become much more prominent in the next 2-4 years?



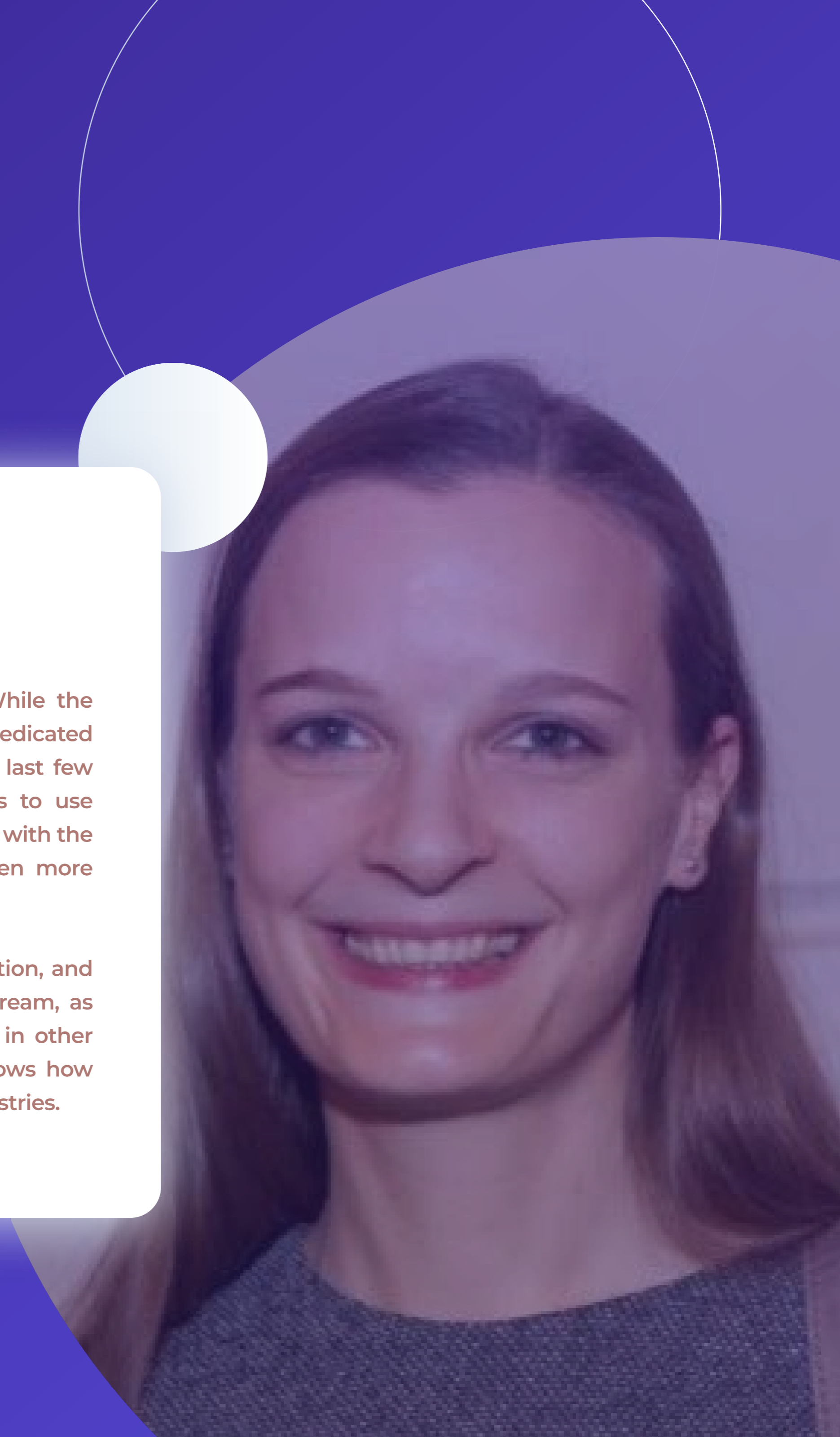
Expert commentary

Margot Mückstein

CEO & CO-FOUNDER, @CLOUDOMATION

When looking at the adoption of AI, an interesting pattern emerges. While the majority of CTOs (59%) report that they use some form of AI, only 25% have dedicated teams of AI experts. This shows how AI products have matured over the last few years: it is no longer necessary to have dedicated teams of AI experts to use packaged AI products like image classification APIs or OCR libraries. This fits with the expectation of most CTOs (66%) that Machine Learning will become even more important in the future, as more such AI products become available.

With 79% of CTOs saying that they have implemented Continuous Integration, and 64% using Continuous Delivery, CI/CD has squarely arrived in the mainstream, as something used not only by software companies but also by companies in other industries that have software development teams. This is amazing. It shows how software development is becoming more and more professional across industries.



04

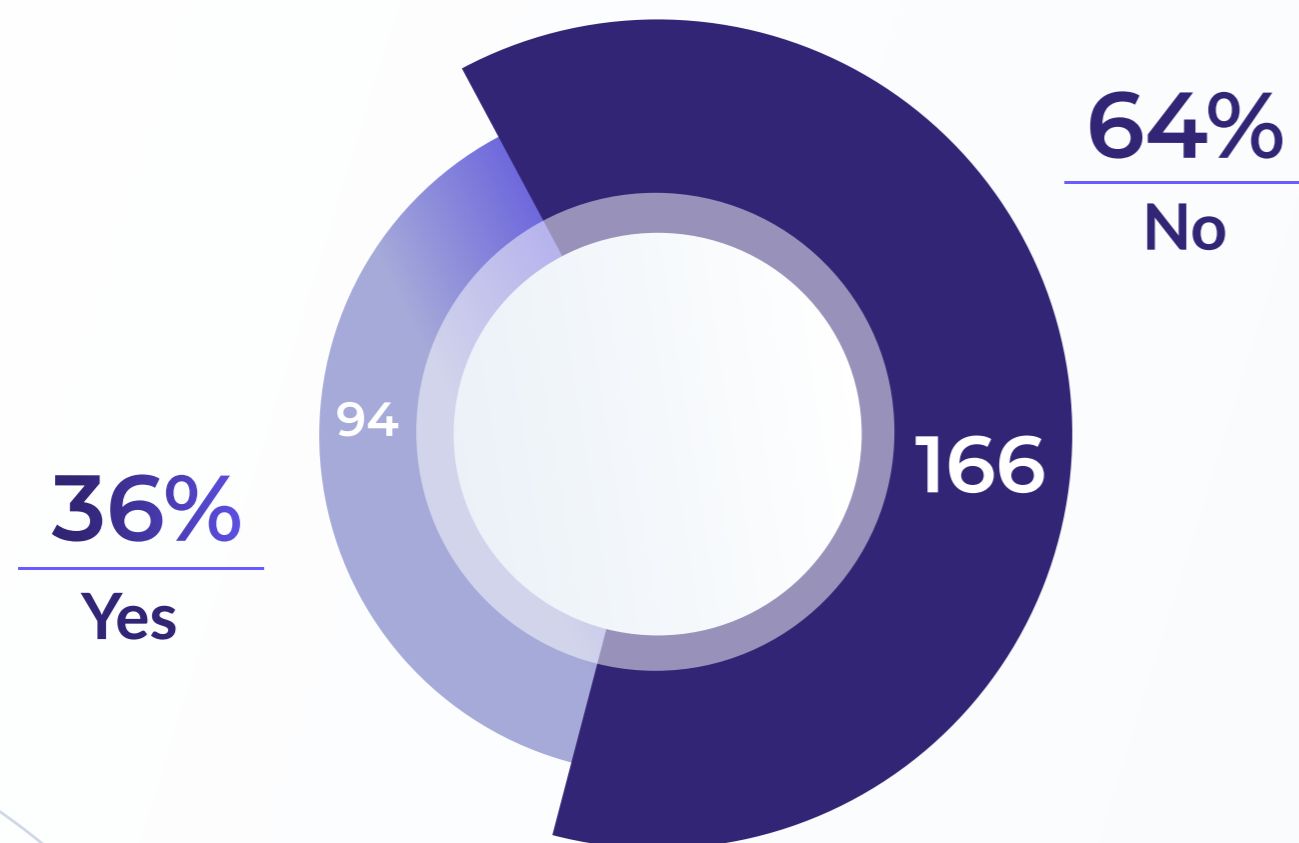
Security

How CTOs are managing risk,
protecting data and IP

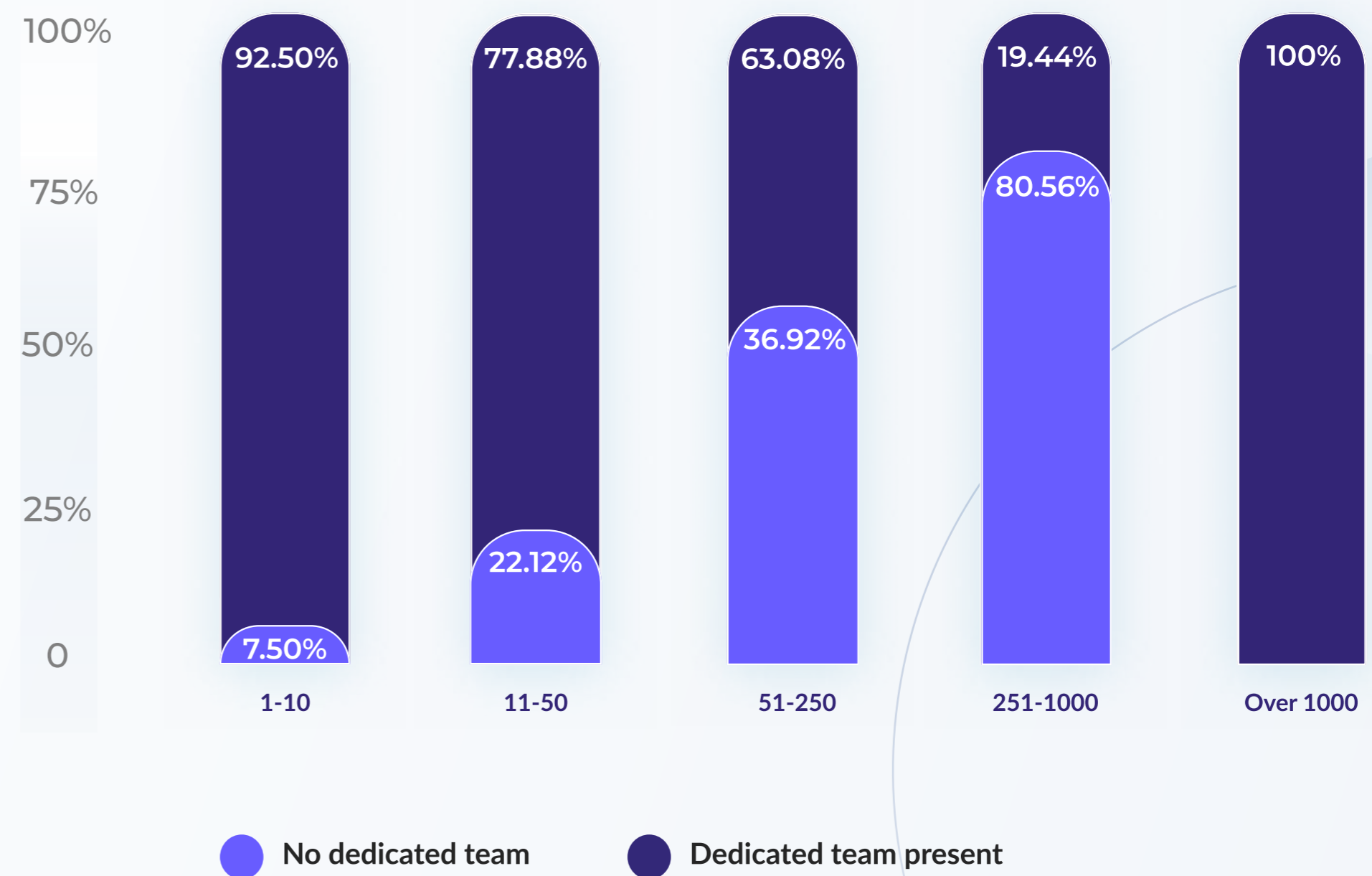
35% of CTOs' companies have no cybersecurity at all (1/2)

Cybersecurity's importance in today's business landscape lies in its potential to safeguard companies against a wide range of threats. The 2023 edition of the CTO Survey highlights the significance of robust cybersecurity practices in organizations and sheds light on the prevailing trends in this critical domain. Our survey revealed that 35% (91) of CTOs reported their companies having no cybersecurity measures in place whatsoever. However, it is encouraging to note that 36% of CTOs stated that their organizations have an internal dedicated security team, indicating a substantial growth from the previous edition's 25%. Notably, organizations with a headcount of at least 1000 employees show a higher propensity to establish in-house teams rather than rely on external providers for their cybersecurity needs.

Do you have a dedicated team or department providing security services in your organization?



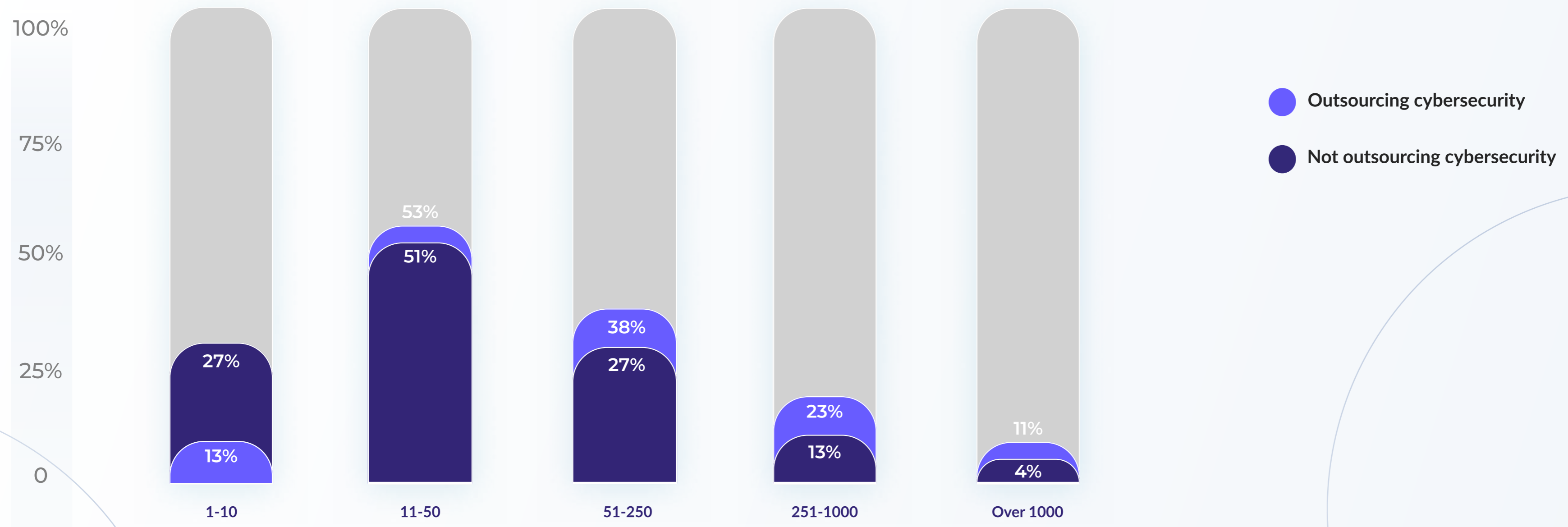
Have dedicated security team?



35% of CTOs' companies have no cybersecurity at all (2/2)

Interestingly, larger organizations with a headcount of at least 1000 employees prefer in-house teams for cybersecurity, emphasizing the need for greater control and tailored security practices. This highlights the urgent need for companies, regardless of size, to recognize the risks of cyber threats and invest in proactive measures to safeguard their digital assets.

Outsourcing cybersecurity and not outsourcing cybersecurity

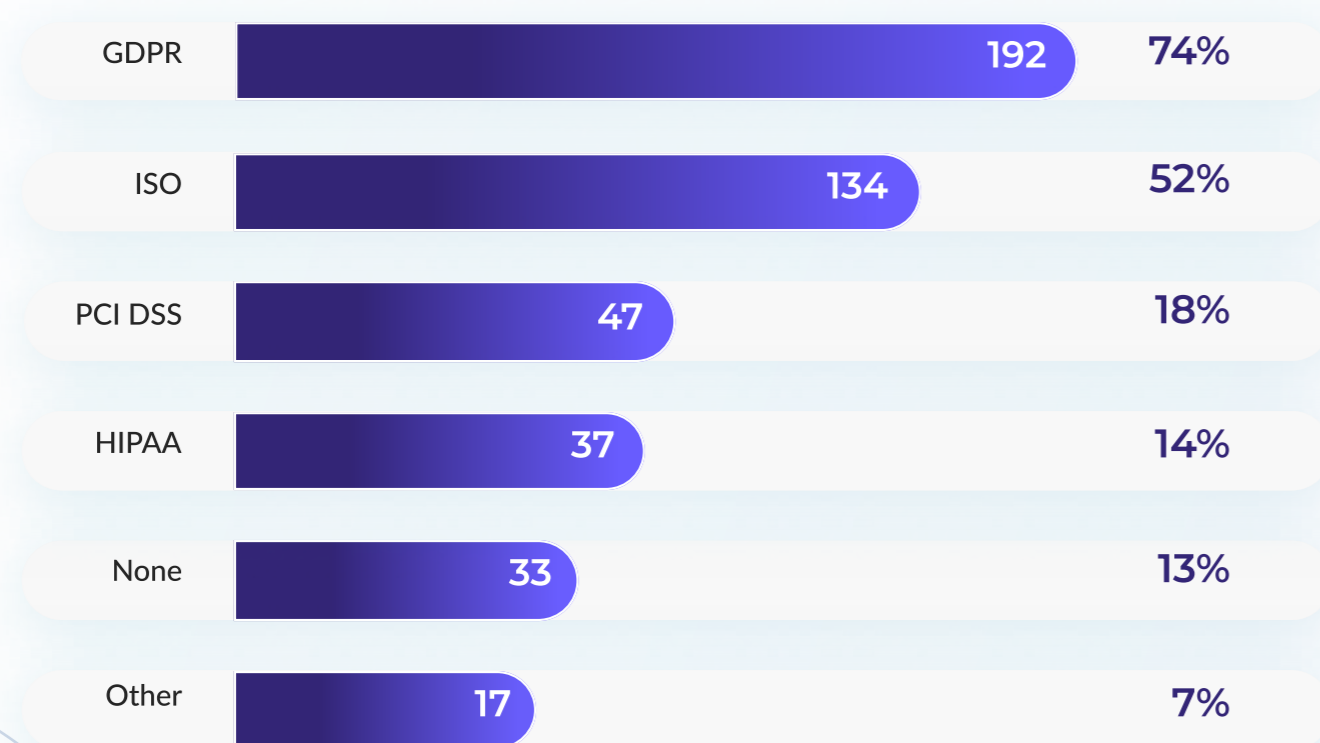


GDPR is the most commonly enforced regulation

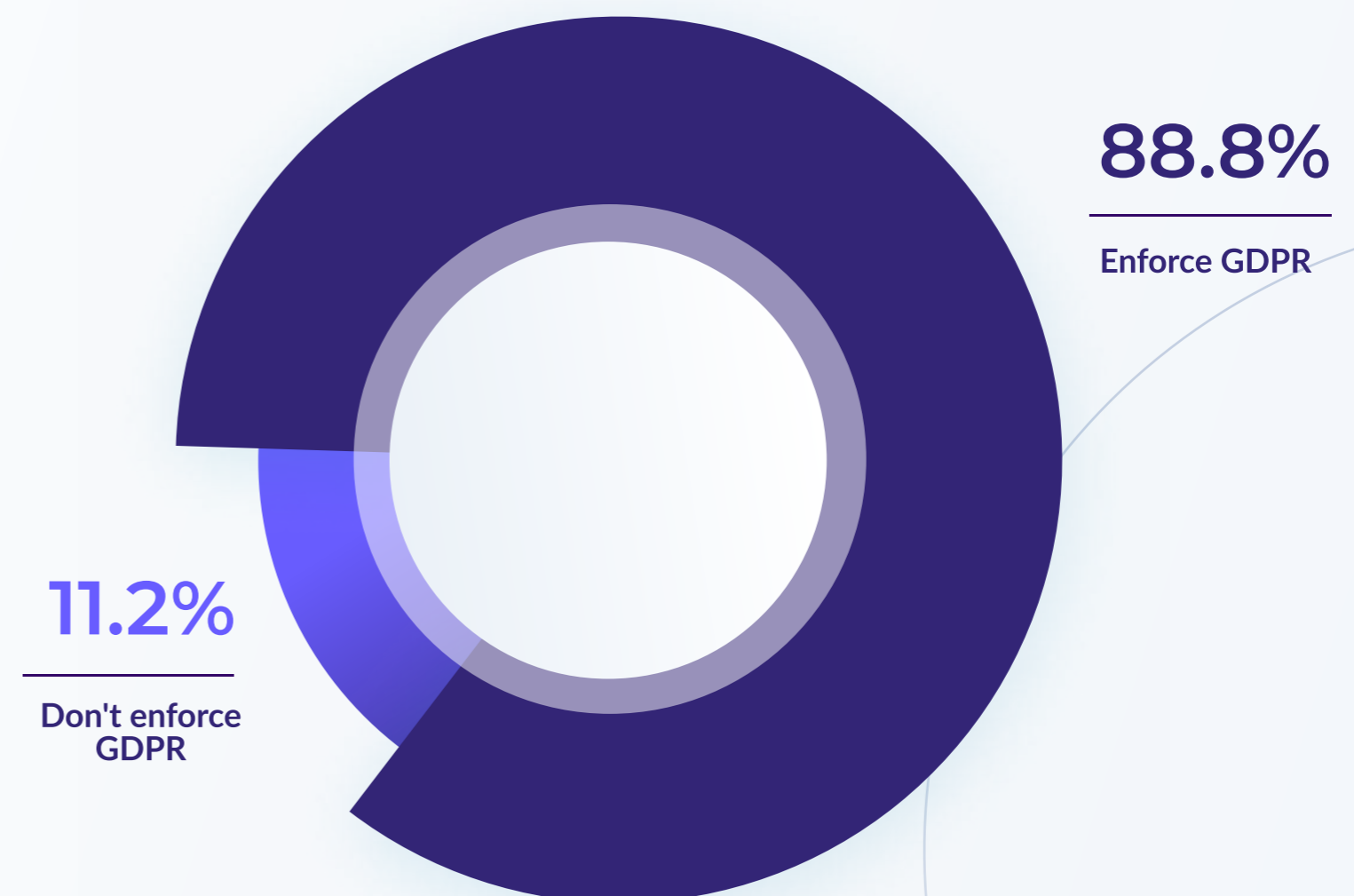
GDPR continues to hold significant importance in the realm of data protection and privacy for European companies. Out of the European companies participating in the survey, only 20 out of 178 reported that they do not enforce the GDPR.

The survey also highlighted that GDPR remains the most commonly enforced regulation, with 74% of the organizations surveyed stating that they have implemented measures to comply with its requirements. These findings demonstrate a positive trend towards increased awareness and adherence to GDPR, indicating a growing recognition of the importance of safeguarding personal data and respecting individual privacy within European companies.

Which of the following standards and regulations do you enforce for the systems in your organization?



Among the European companies responding to the survey...



Over half of the organizations don't have a cyber insurance policy in place of the attack

Having a robust cyber insurance policy is becoming increasingly vital for companies in today's digital landscape. It provides an additional layer of protection and financial support in the event of a cyber-attack or data breach.

However, the CTO Survey 2023 reveals a concerning statistic, with slightly above half of the organizations surveyed (51.5%) admitting that they don't have a cyber insurance policy in place to mitigate the potential damages caused by such incidents. This highlights a significant gap in preparedness and exposes these companies to financial risks and liabilities associated with cyber attacks.

Do you have a cyber insurance policy in place in case of an attack?



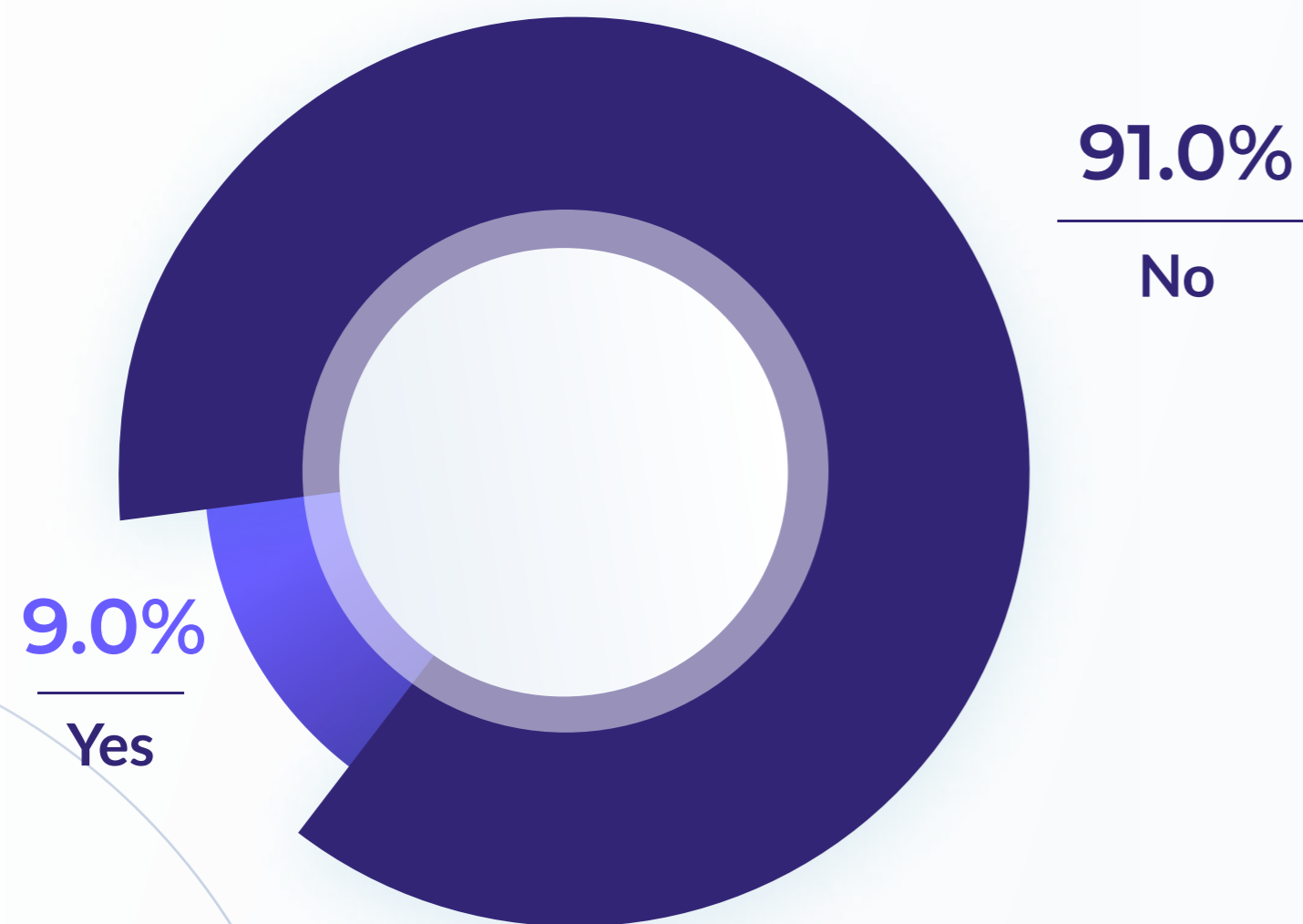
Human error still the biggest cybersecurity risk

Cybersecurity attacks continue to pose significant threats to organizations, with the potential to compromise sensitive data, disrupt operations, and cause financial losses.

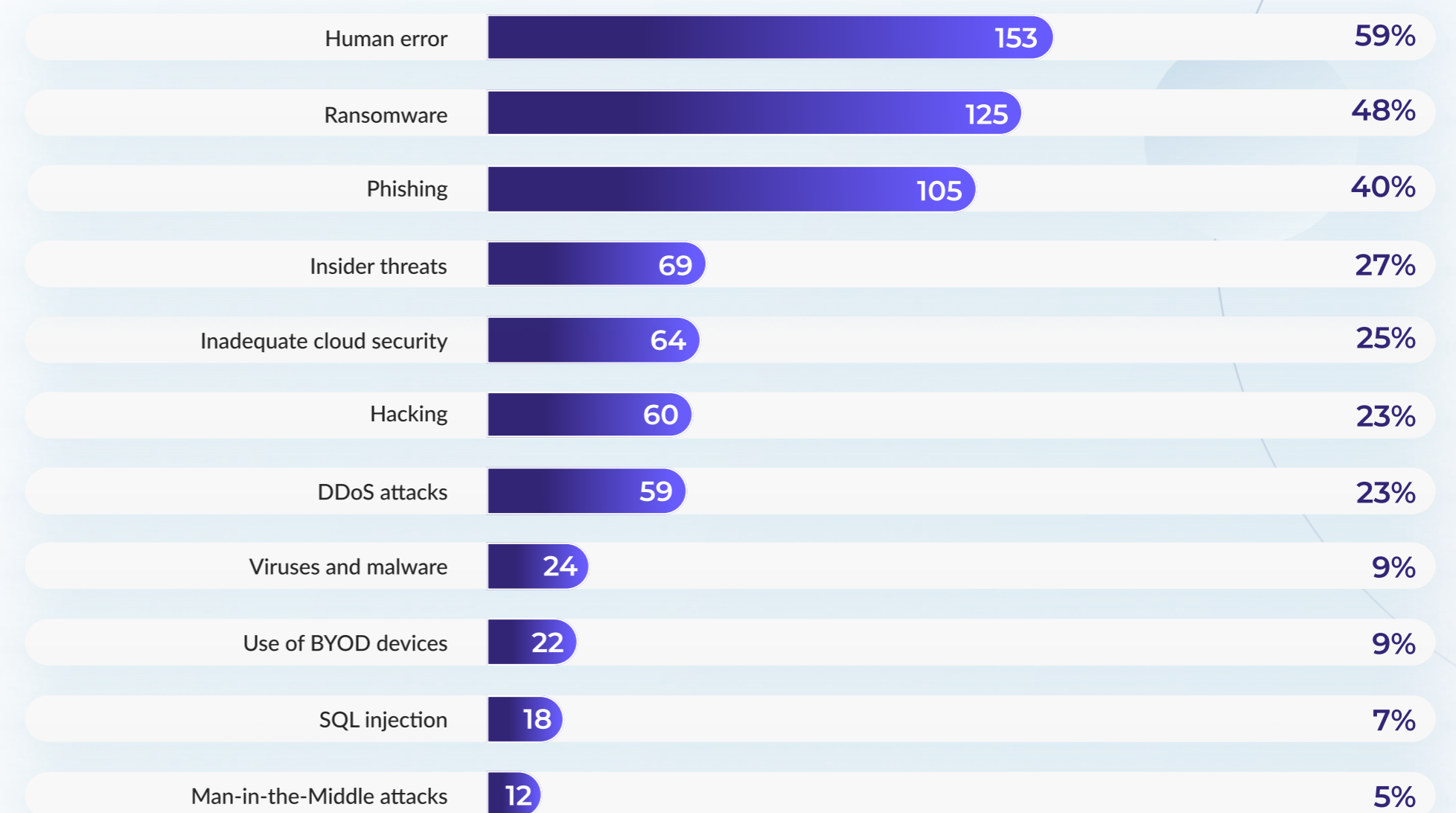
According to the CTO Survey 2023, a notable 59% of respondents identified human error as the biggest security threat. This finding surpasses the concerns associated with ransomware (48%) and phishing (40%). This underscores the key role that human factors play in cybersecurity incidents, emphasizing the need for comprehensive training and awareness programs to address and mitigate these risks.

While technological defenses are essential, organizations must recognize that human behavior and decision-making can have an impact on the overall security posture. By focusing on human risk management, companies can take significant steps toward fortifying their defenses against cyber threats.

Did your organization fall victim to a cyberattack within the last 12 months?



Which of the following do you consider the biggest cybersecurity threats?



Bring Your Own Device policies don't have to mean reduced security

Although Bring Your Own Device (BYOD) Policies are not new, they have become increasingly important in the current remote work landscape.

With many employees working from home, the use of personal devices for work purposes has become more prevalent. However, the CTO Survey 2023 reveals that not all companies embrace the idea of BYOD. Approximately half of the respondents stated that their organizations do not have a BYOD policy, reflecting similar results from the previous year. This hesitation may stem from concerns about data security, privacy, and the challenges associated with managing a diverse range of devices. As remote work continues to shape the modern workplace, companies will need to carefully assess the benefits and risks of BYOD policies to strike a balance between productivity and security.

Does your organization have a Bring Your Own Device policy in place?



05

Management and leadership

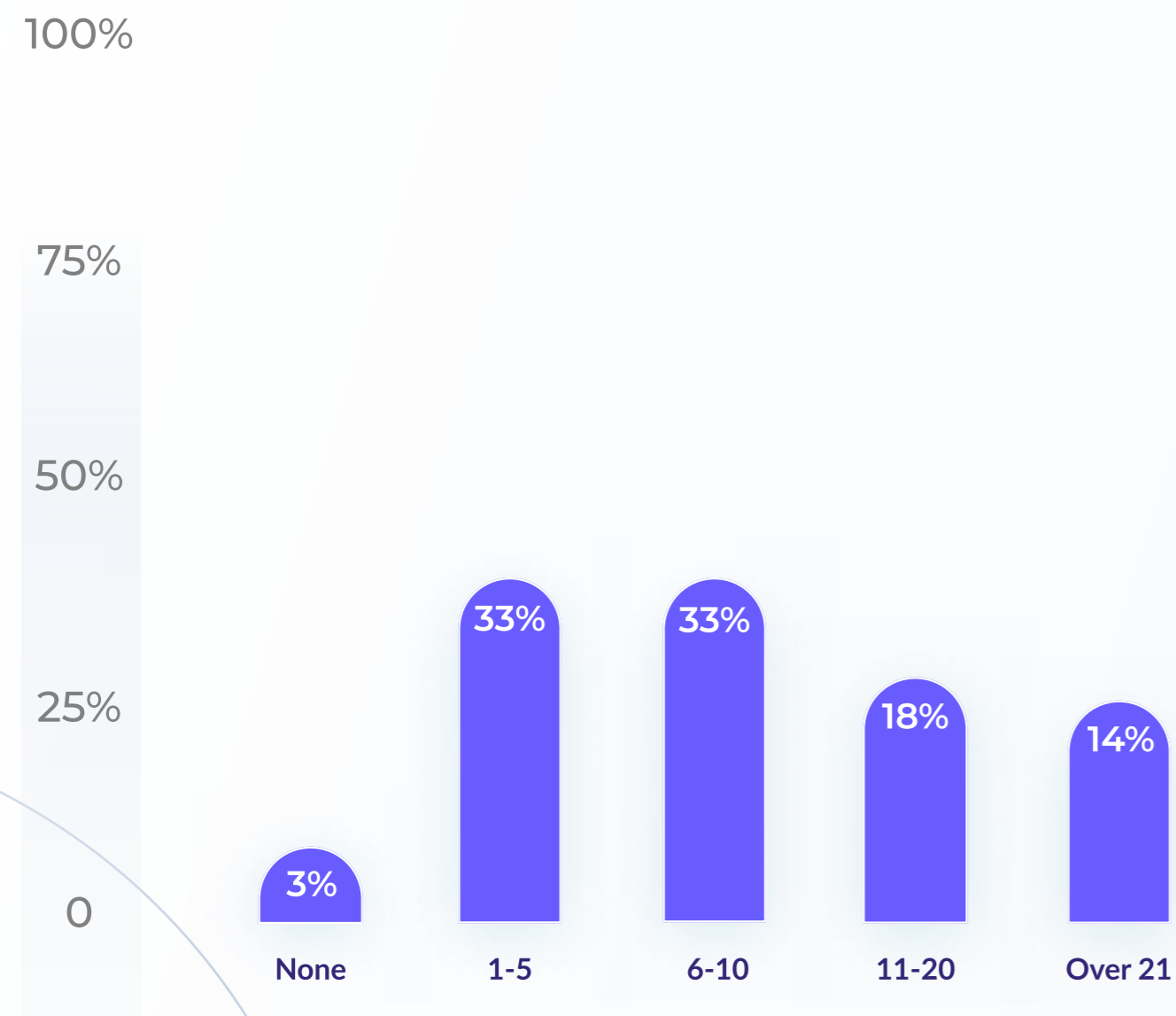
The CTO's role in enhancing
the performance and success
of their teams

CTOs value outcome-oriented assessment of their teams' performance

The majority of surveyed CTOs have a moderate-sized team reporting directly to them, with 33% of CTOs indicating that they have 1-5 people reporting to them, followed by another 33%, who have 6-10 people reporting to them. In terms of measuring team performance, the most common method reported by the CTOs is measuring the business value delivered, with 48% of CTOs utilizing this approach.

In terms of other methods used by CTOs to assess performance, it seems that Delivering Business Value is becoming the most popular among CTOs. Compared to last year's survey, they pushed Periodic Performance Reviews down one position in the ranking.

How many people report directly to you?



How do you measure your teams' performance?

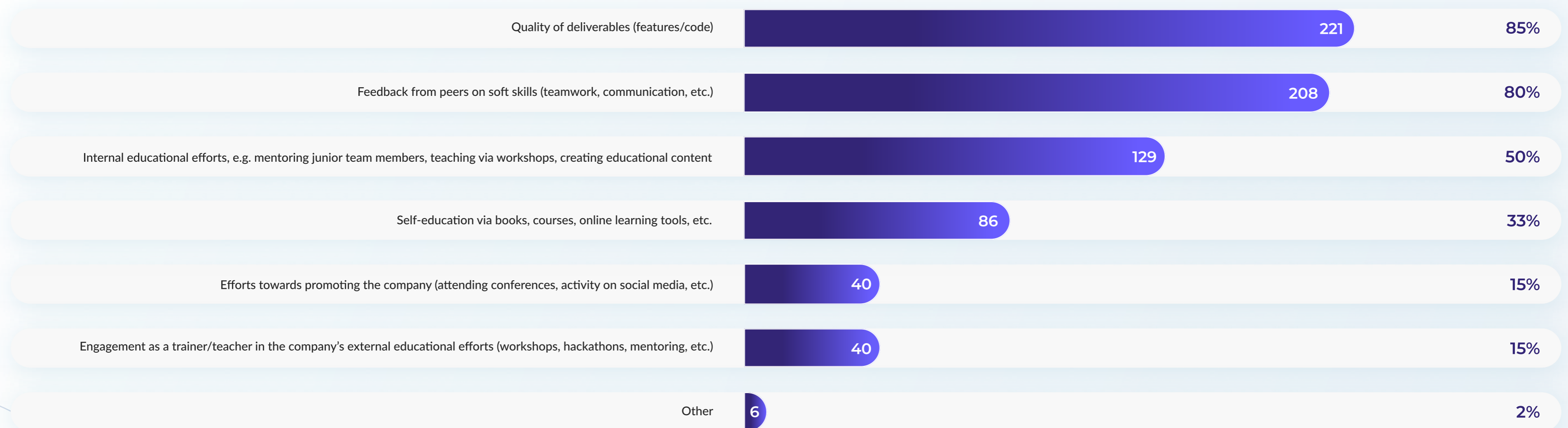


Quality of work and soft skills are a winning combination

When measuring the performance of team members, CTOs primarily consider the quality of deliverables. Feedback from colleagues on soft skills, such as teamwork and communication, is highly valued. Internal educational efforts and self-education are also considered important factors.

In addition, developers who want to go one step further should focus primarily on mentoring younger team members and improving their own skills – both of which were considered far more important than other activities, such as teaching at workshops and promoting the company at events and on social media.

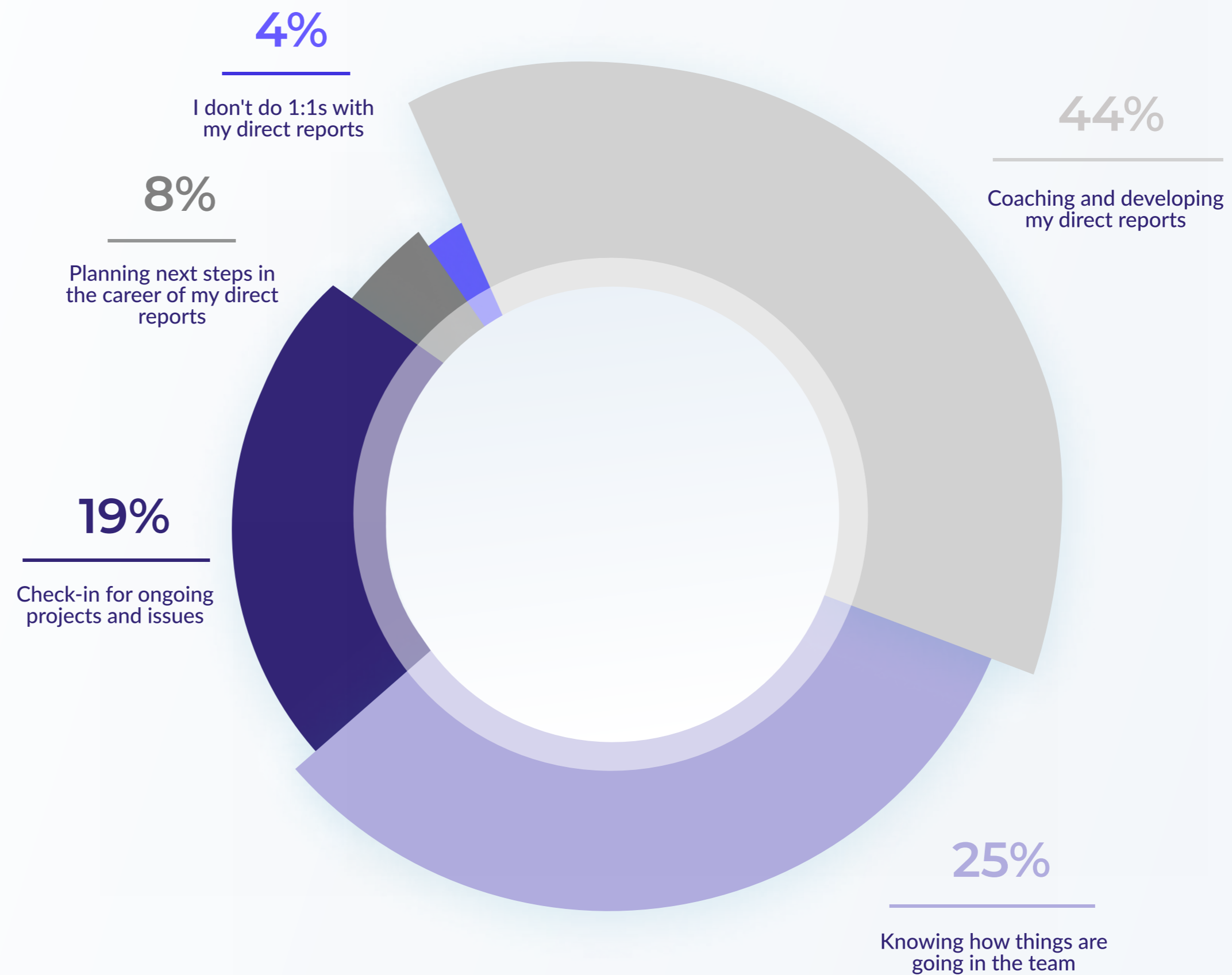
When you measure the performance of your team members, which of the following influence your assessment?



Being transparent and honest, as well as empowering employees are crucial for CTOs (1/2)

96% of surveyed CTOs conduct 1:1 meetings with their teams. The main value they reported receiving from 1:1s is coaching and developing their team members, with 44% of CTOs indicating this as the primary benefit. This is followed by knowing how things are going in the team, reported by 25% of CTOs, and using 1:1s as a check-in for ongoing projects and issues, reported by 19% of CTOs.

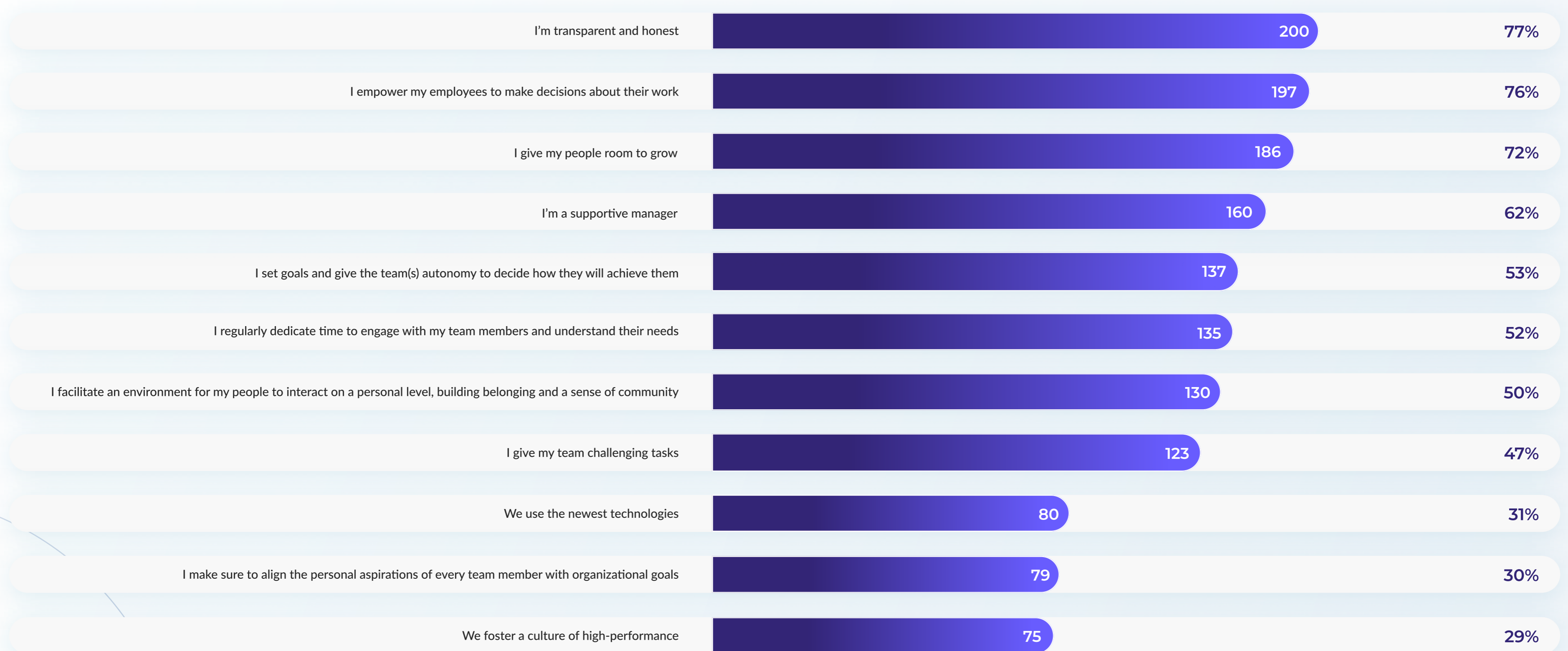
What is the main value that you get from 1:1s with your direct reports?



Being transparent and honest, as well as empowering employees are crucial for CTOs (2/2)

In terms of keeping staff motivated, the most commonly reported approaches by CTOs are being transparent and honest (77%), empowering employees to make decisions about their work (76%), and giving them room to grow (72%).

How do you keep your staff motivated?



Agile methodologies remain the top project management frameworks

Overall, Scrum and Kanban are the dominant project management frameworks among the CTOs' teams, reflecting the popularity of Agile methodologies. Interestingly, Scrumban, a hybrid approach combining elements of Scrum and Kanban, is utilized by 21% of the CTOs' teams. Traditional methodologies like Waterfall still have a notable presence but are less prevalent compared to Agile frameworks.

What project management frameworks do your teams use?

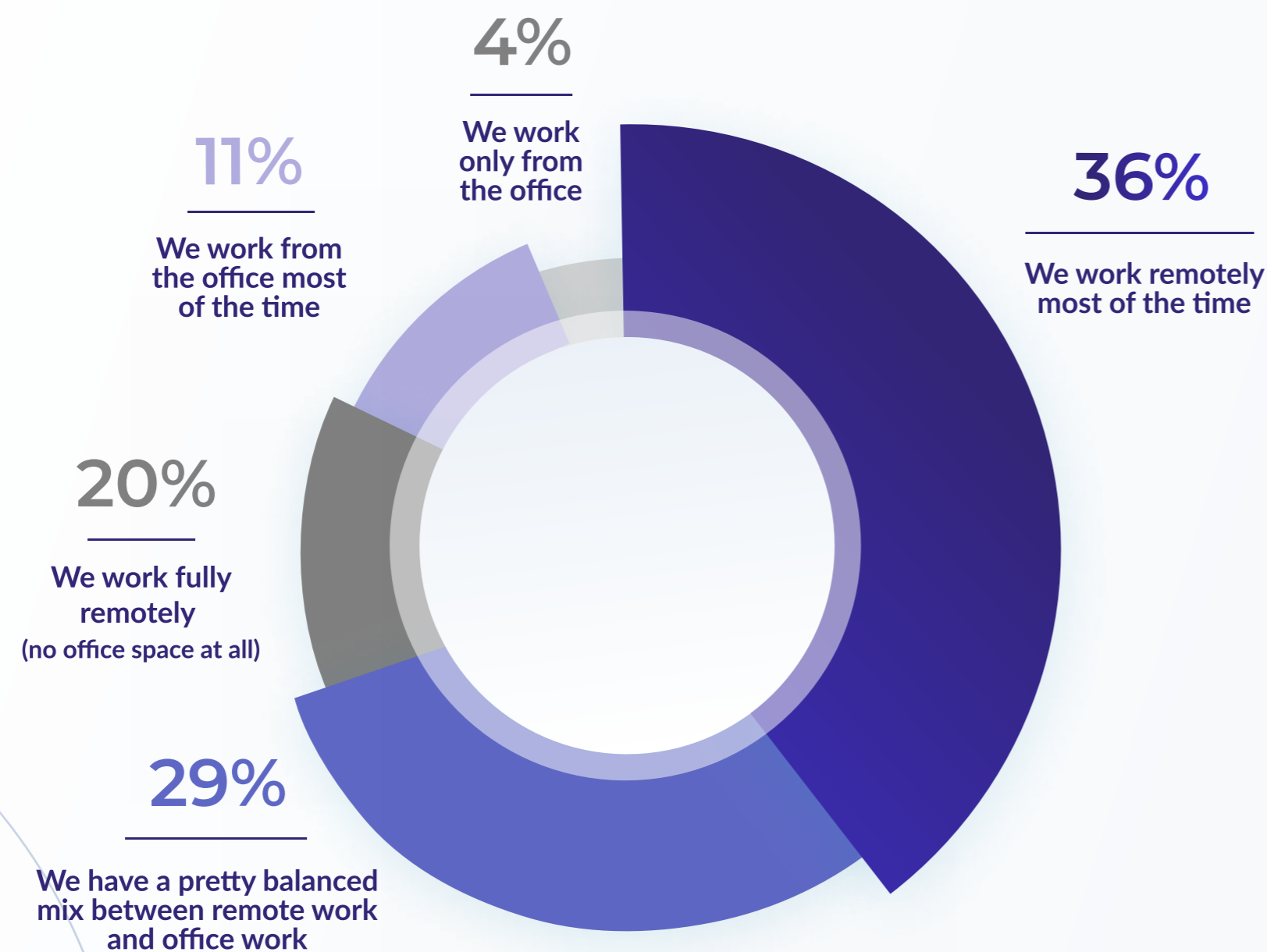


Remote work has become a viable and effective option for many CTOs

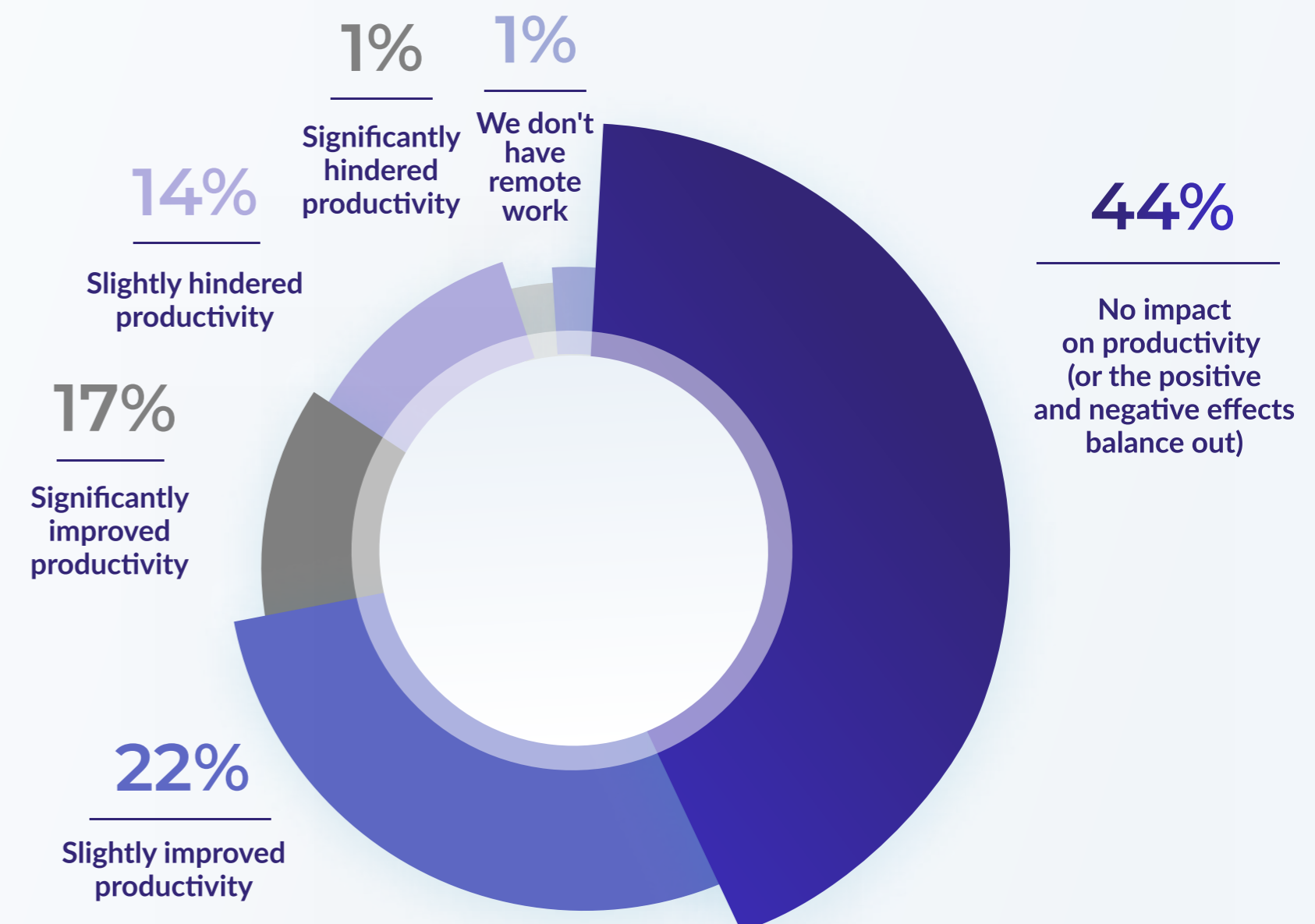
Based on the responses provided, the majority of CTOs and their engineering teams work remotely to some extent. The most common response indicates that teams work remotely most of the time, with 36% of CTOs reporting this arrangement. Additionally, 29% of CTOs reported having a balanced mix between remote work and office work, while 20% of CTOs reported working fully remotely without any office space.

In terms of the impact of remote work on overall productivity, the largest group of CTOs (44%) reported no significant impact on productivity. However, a considerable number of CTOs (22%) indicated that remote work slightly improved productivity, while 17% of CTOs reported a significant improvement. On the other hand, 14% of CTOs noted that remote work slightly hindered productivity, and only a small number (1%) reported a significant hindrance.

To what degree do you and your engineering teams work remotely?



If you have remote work in your teams, how would you rate its impact on overall productivity?



Expert commentary

Eric Naiburg

COO, SCRUM.ORG

The continued shift from measuring outputs to measuring business value is a promising trend. A focus on business value combined with supporting individuals to keep growing their skills is a great way to increase morale and retain top talent which in turn will keep increasing the business value delivered. This will help the organization overall.



06

Hiring

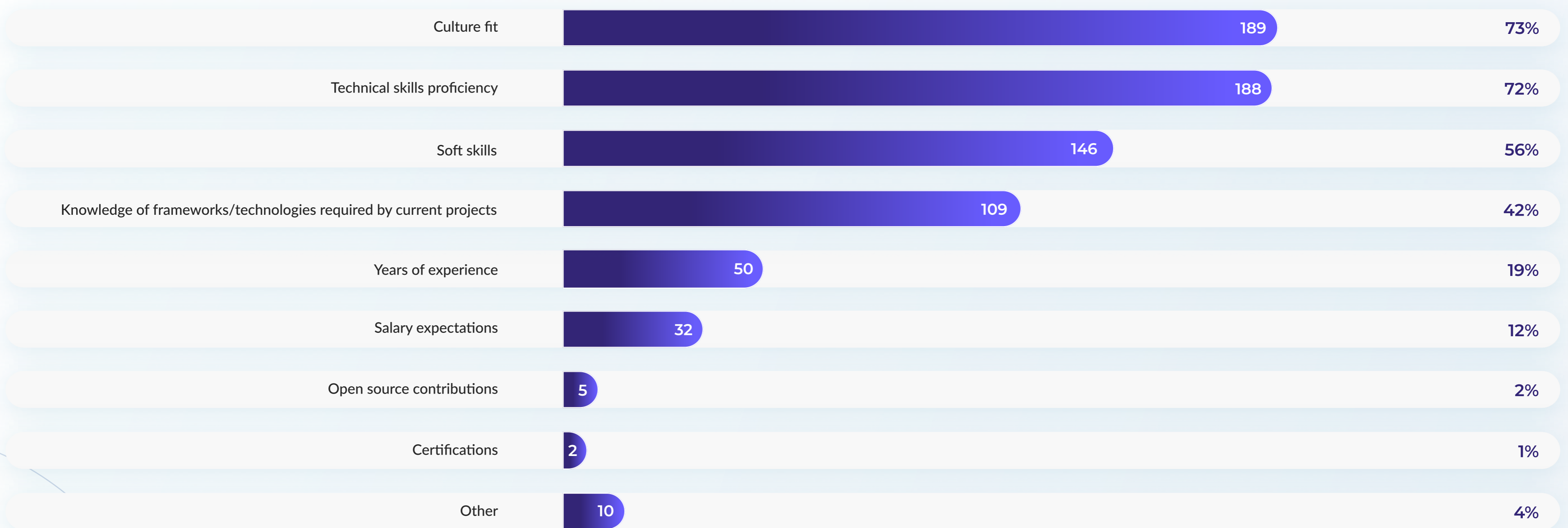
How do CTOs find talent
and what skills do they
value most?

BY STX NEXT

CTOs consider employee referrals as the most efficient hiring method (1/2)

When it comes to the most important hiring criteria, culture fit and technical skills proficiency were both given by over 70% of surveyed CTOs. Soft skills were also important for over 50% of the responders. Overall, the analysis reveals that CTOs prioritize finding candidates who align with the company culture, possess strong technical skills, and demonstrate valuable soft skills.

What are your most important hiring criteria?

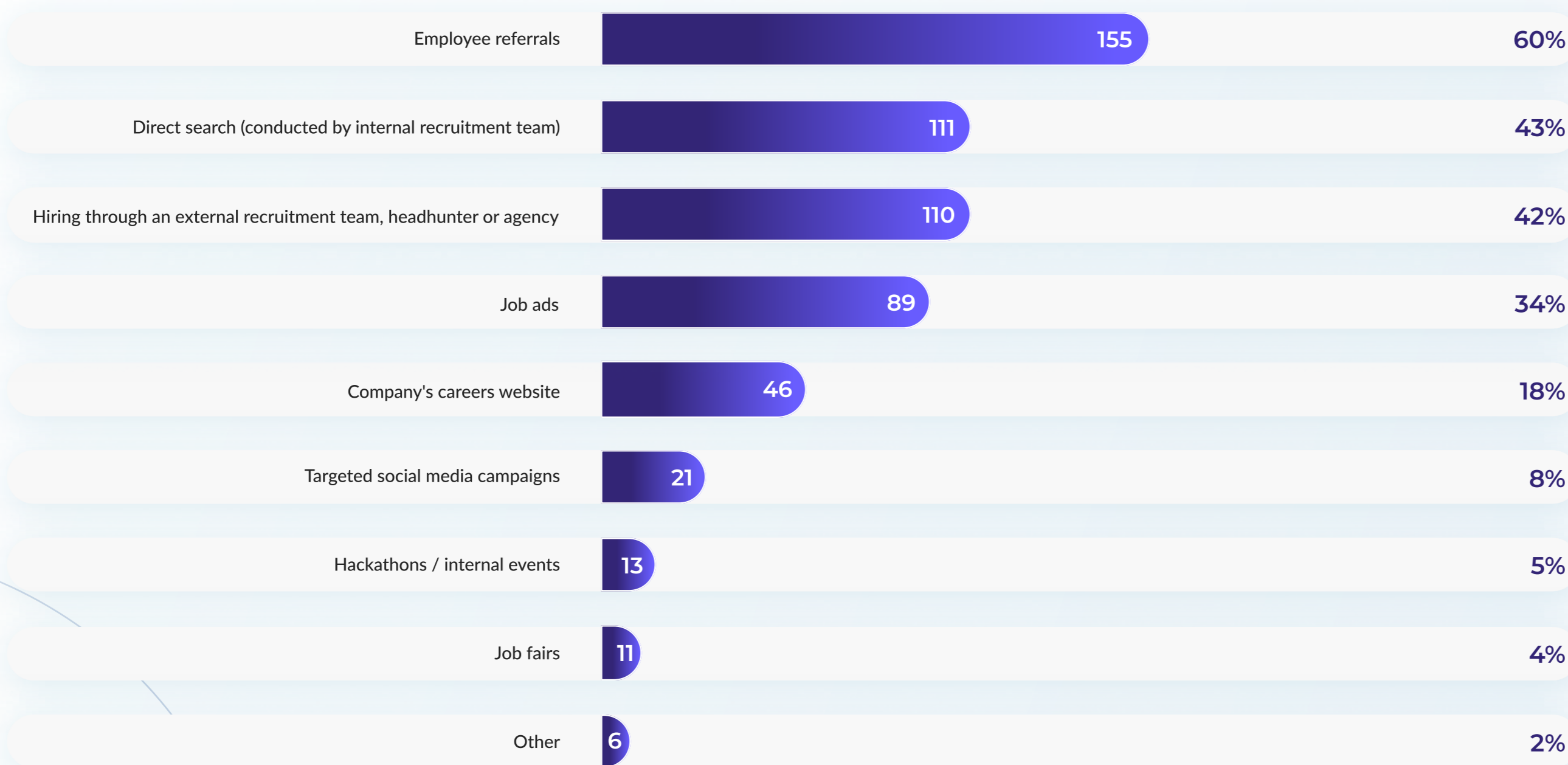


CTOs consider employee referrals as the most efficient hiring method (2/2)

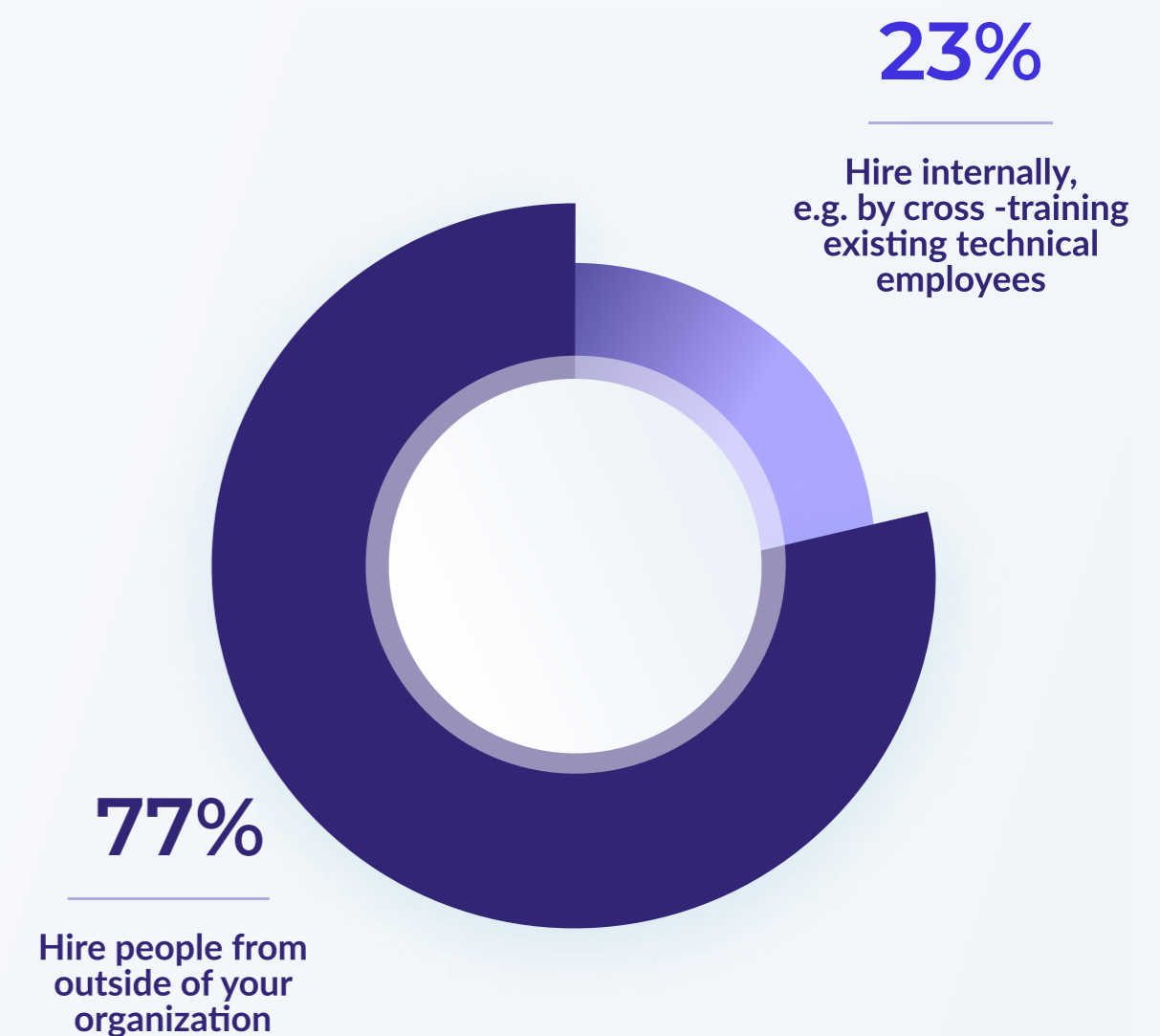
What are the responders' preferred methods for sourcing talent? 60% of the CTOs consider employee referrals as the most efficient method, while job fairs and events such as hackathons were the least popular out of the offered options.

The majority of CTOs (77%) indicated a preference for hiring people from outside of their organization when recruiting, thus bringing in fresh perspectives and diverse experiences.

What's your most efficient method to hire talent?



When you're recruiting, do you prefer to:



Expert commentary

James Milligan

GLOBAL HEAD OF TECHNOLOGY SOLUTIONS AT HAYS

Here at Hays, we're seeing a large disparity between the demand for skilled workers in technology and the number of those with the experience and know-how to fill these roles. This is true across the globe and remains unchanged, despite the stage of the economic cycle we currently find ourselves in. In short: there aren't enough people to fulfill these responsibilities and, as a result, employers face a fight for tech talent.

What can organisations do to boost their chances of success when it comes to hiring? It starts with understanding the needs of the business, not just now but in five years' time too. The rate of innovation means that companies will need to be Agile in order to keep pace with technological advancement. That starts with bringing the right people on board, those who don't just have the skills to do the job now, but who can learn to tackle tomorrow's challenges.



Expert commentary

James Milligan

GLOBAL HEAD OF TECHNOLOGY SOLUTIONS AT HAYS

Next, your hiring process. Yes, it's important to ensure you're recruiting the right person, but a complicated series of interviews or tests can be onerous. Ultimately, the longer the process, the more chance there is of an applicant finding an opportunity with another company.

We're in a situation now where many candidates crave job security and don't want to risk a wrong move. Besides offering a salary that is at least in line with the market, you need to showcase the other benefits such as learning resources, flexible working and development opportunities.

Remember, the hiring process isn't just you evaluating applicants – it's their chance to assess you.



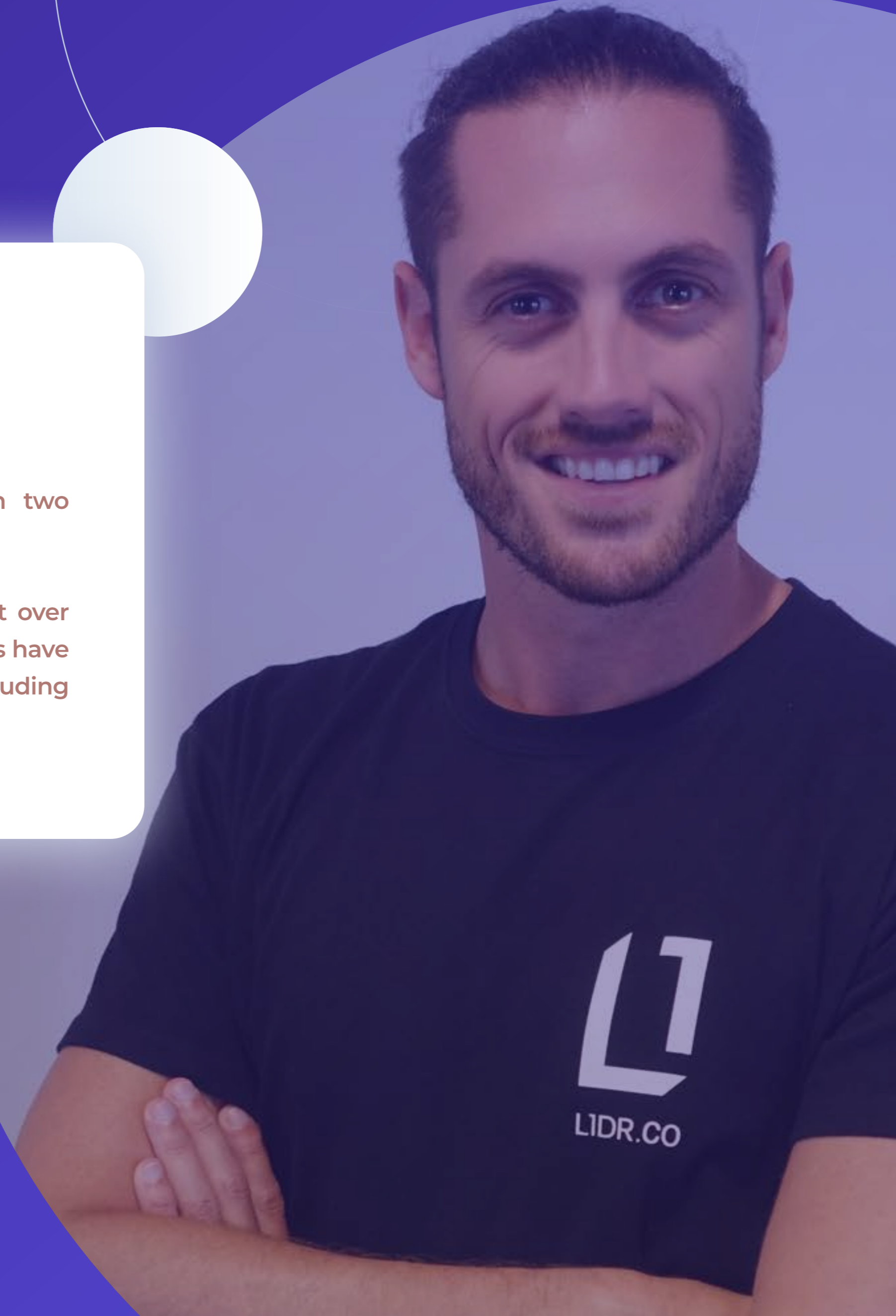
Expert commentary

Alvaro Moya

CTO & FOUNDER AT LIDR

In recent years, IT hiring practices have undergone notable shifts, with two particularly impactful changes taking center stage.

Firstly, technology leaders are now placing a higher emphasis on cultural fit over technical proficiency when evaluating potential candidates. Secondly, soft skills have consolidated as a paramount consideration for all levels of experience, including junior and mid roles.



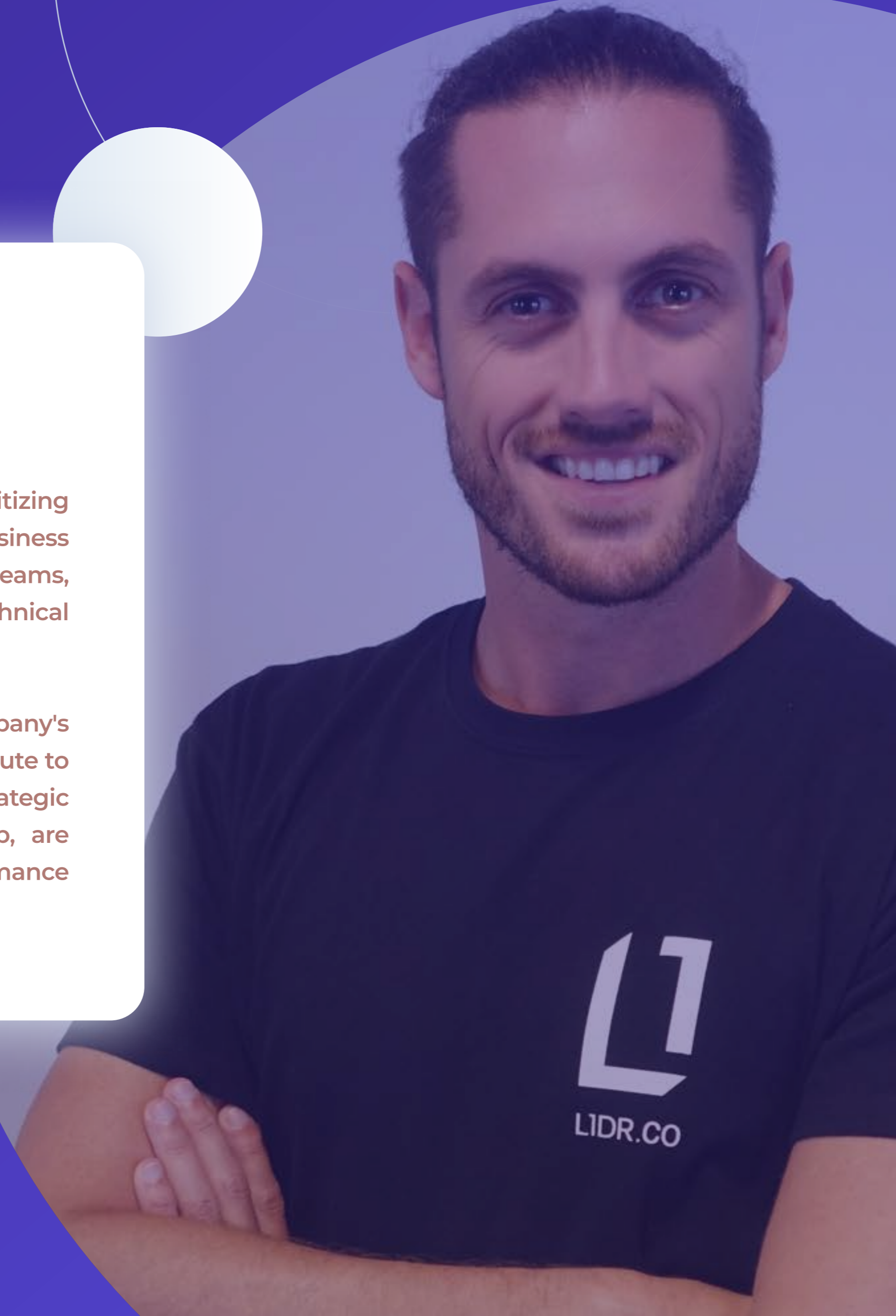
Expert commentary

Alvaro Moya

CTO & FOUNDER AT LIDR

This marks a significant departure from the longstanding tradition of prioritizing technical skills above all else. As technology becomes more integrated into business operations, the ability to effectively communicate ideas, work with diverse teams, and adapt to rapidly changing environments has become just as critical as technical expertise.

CTOs recognize that a candidate's ability to seamlessly integrate into the company's culture and values can greatly influence team dynamics and ultimately contribute to the overall success of new collaborators. Once onboarded, qualities like strategic vision, communication in different contexts and channels, and leadership, are essential for fostering collaboration, innovation, and a high-performance environment within tech teams.



07

Training

What skills do CTOs consider particularly important?

CTOs value both soft skills and hard skills when it comes to growing their team members

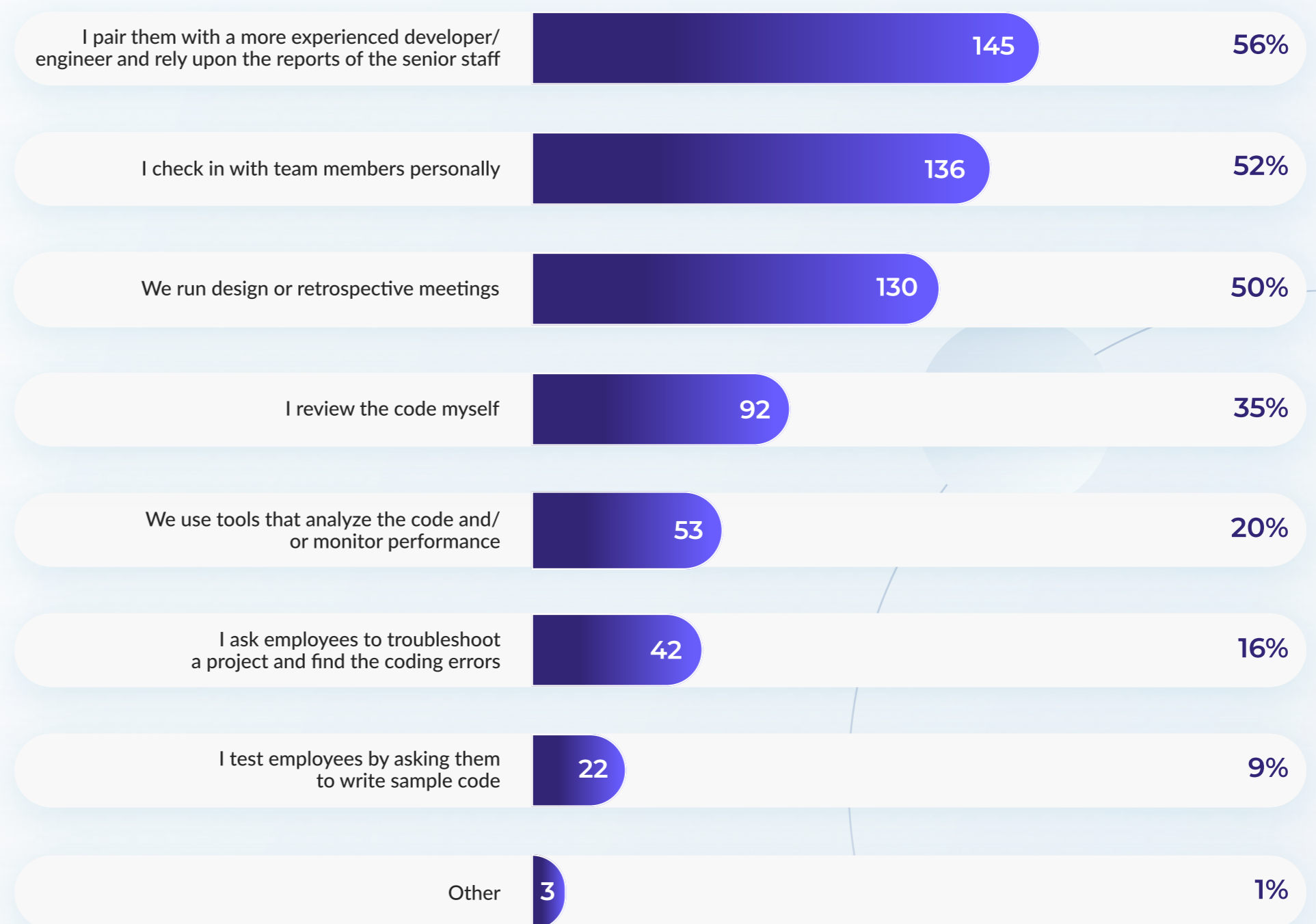
When asked which skills are the most important – soft ones or hard ones, our CTOs were almost evenly divided. In the end, it was the soft skills (communication, giving/receiving feedback, leadership qualities) that raised slightly more votes. That said, nearly half of the CTOs still prioritize hard skills (such as programming/technical knowledge & ability).

How do CTOs identify technical skill gaps on their teams? The most common methods involve leveraging the expertise of experienced staff, engaging in personal check-ins, and conducting design or retrospective meetings.

When you're growing your team members, which skills are the most important?



How do you identify technical skill gaps on your team?



Technical knowledge remains the most important skill for the CTOs' team members

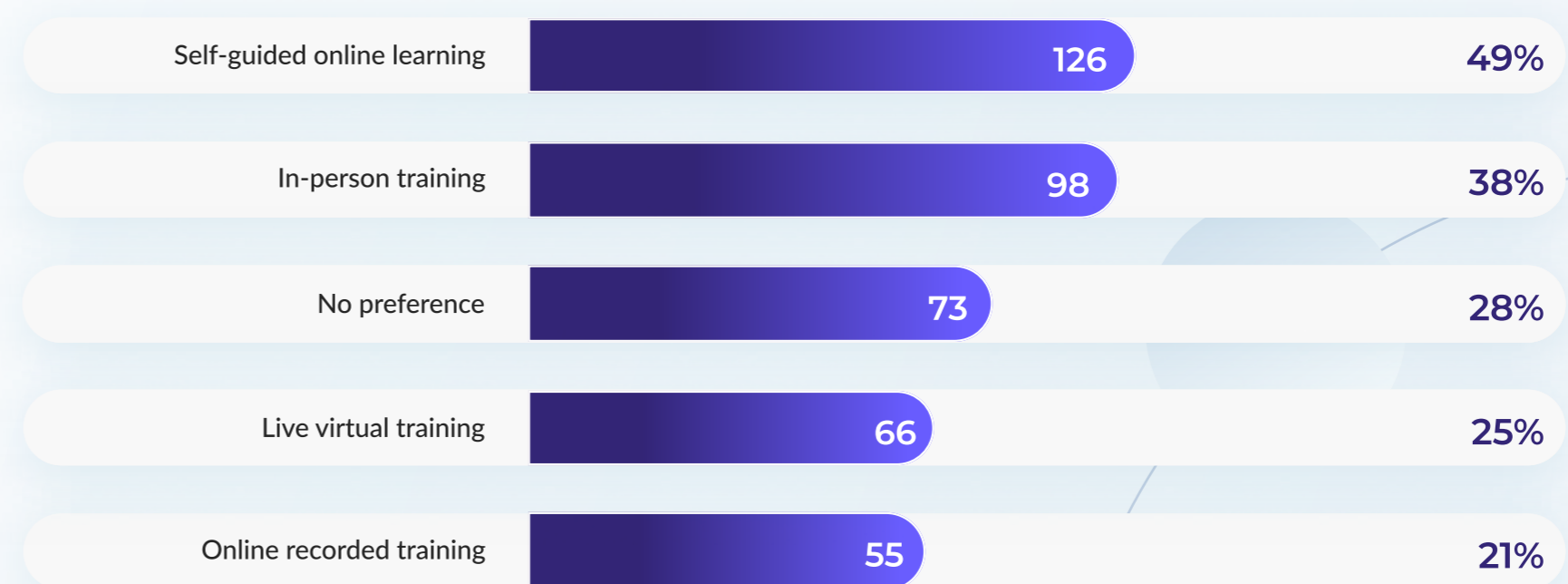
When asked about the most important skills for a team members' growth, technical knowledge was appointed as number 1, followed by attitude and communication skills. Next in line were prioritization and speed of implementation, with creativity and ingenuity closing down the list.

How can team members obtain these important skills? Close to half of the surveyed CTOs (49%) point to self-guided online learning as a great form of training activity. This option is flexible, accessible, and can cater to individual learning needs. That said, in-person training still holds value for a significant portion of CTOs – 38% of them marked that answer as well. It is worth noting that a considerable number of CTOs (28%) expressed no specific preference, which can indicate their openness to different training methods based on specific circumstances.

What skills do you deem most important for your team members' growth?



Which training activities do you prefer your team(s) to attend?



Expert commentary

Łukasz Grzeszczyk

CEE EXECUTIVE DIRECTOR - INVESTORS CONSULTING & TALENT
LOCATION STRATEGY AT HAYS

I believe that the expectations regarding training among CTOs align with overall industry standards. Any learning opportunity should have a practical foundation and be rooted in real-life project scenarios. Proper training must feature tangible case studies demonstrating the application of technology, the implementation of solutions, or tech-based responses to various business challenges.

To be successful, all training sessions for tech talent should be easily accessible - that is, ideally delivered online as webinars or interactive workshops, with recordings made available to participants for later review. When it comes to training requirements, they should primarily reflect technologies and tools needed to safeguard projects from a technological standpoint.



Expert commentary

Łukasz Grzeszczyk

CEE EXECUTIVE DIRECTOR - INVESTORS CONSULTING & TALENT LOCATION STRATEGY AT HAYS

However, hard skills are just the tip of the iceberg. In the contemporary landscape where business and technology intersect, effective communication is pivotal. It entails fostering collaboration and driving desired transformations. And CTOs are aware of this, stressing the fundamental role of soft skills among tech teams from top to bottom. Therefore, skills such as communication, relationship-building, people management, talent acquisition and retention, motivation, and decision-making very often are priorities for CTOs.

In their learning, CTOs highly value interactions with their professional community to share knowledge and showcase practical solutions from their work experience. It's no surprise that, as technology more closely intertwines with business, the more essential it becomes to know how various organisations approach similar challenges.



08

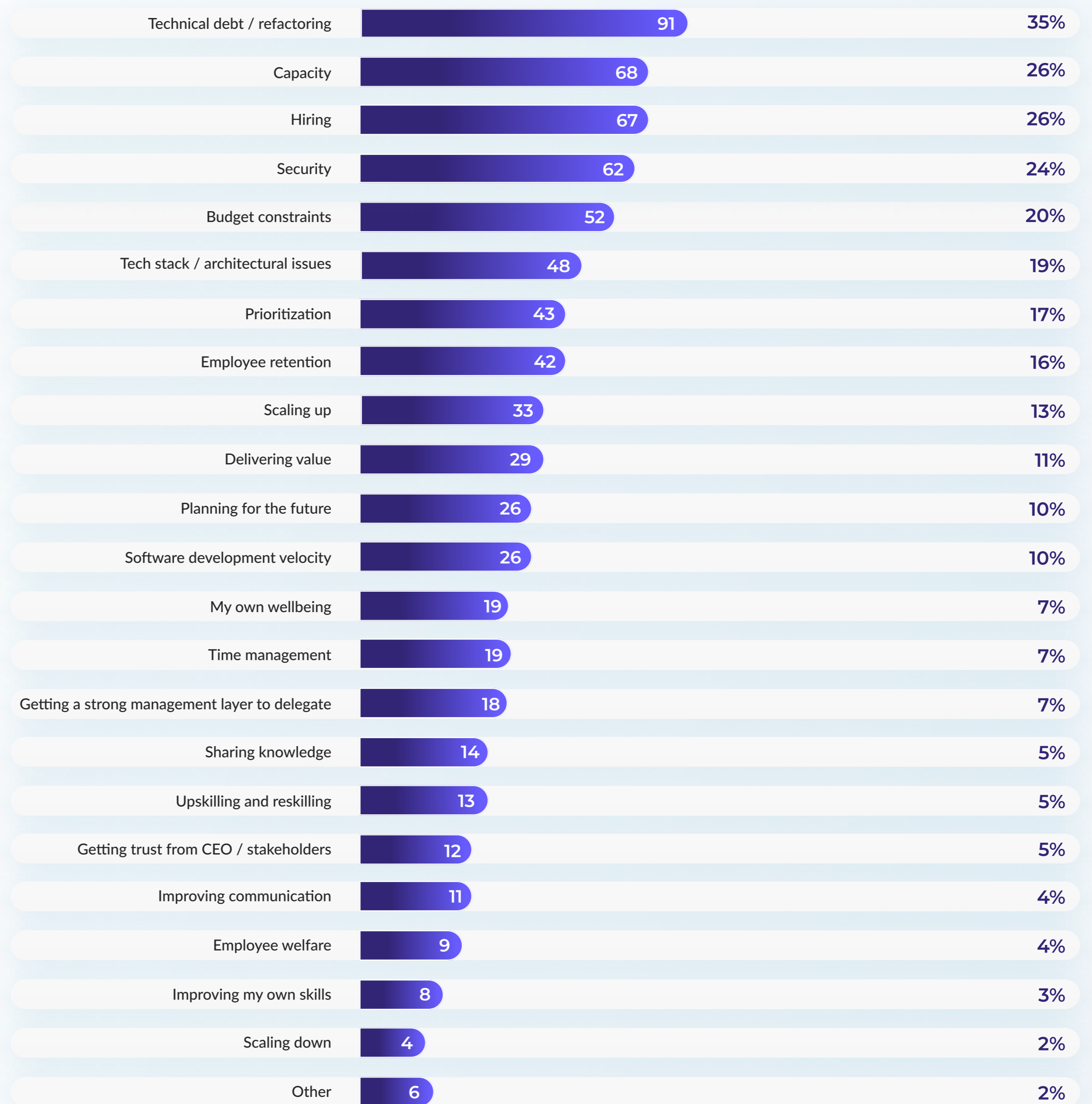
Challenges

What obstacles are CTOs
trying to overcome?

CTOs' foremost concerns – technical debt and refactoring

In 2022 & 2023, CTOs have been grappling with a pressing concern that has risen to the forefront of their agendas – technical debt and refactoring. As businesses embraced new technologies, the accumulation of technical debt became a formidable obstacle, demanding strategic planning and swift action to ensure long-term efficiency. Alongside technical debt, CTOs grappled with staffing and attrition challenges. Capacity emerged as their second-biggest concern, reflecting the need for efficient resource management. Hiring proved to be the third most significant challenge, highlighting the fierce competition for skilled professionals in the tech sector. Additionally, CTOs prioritized maintaining robust security measures to safeguard their organizations from ever-evolving cyber threats.

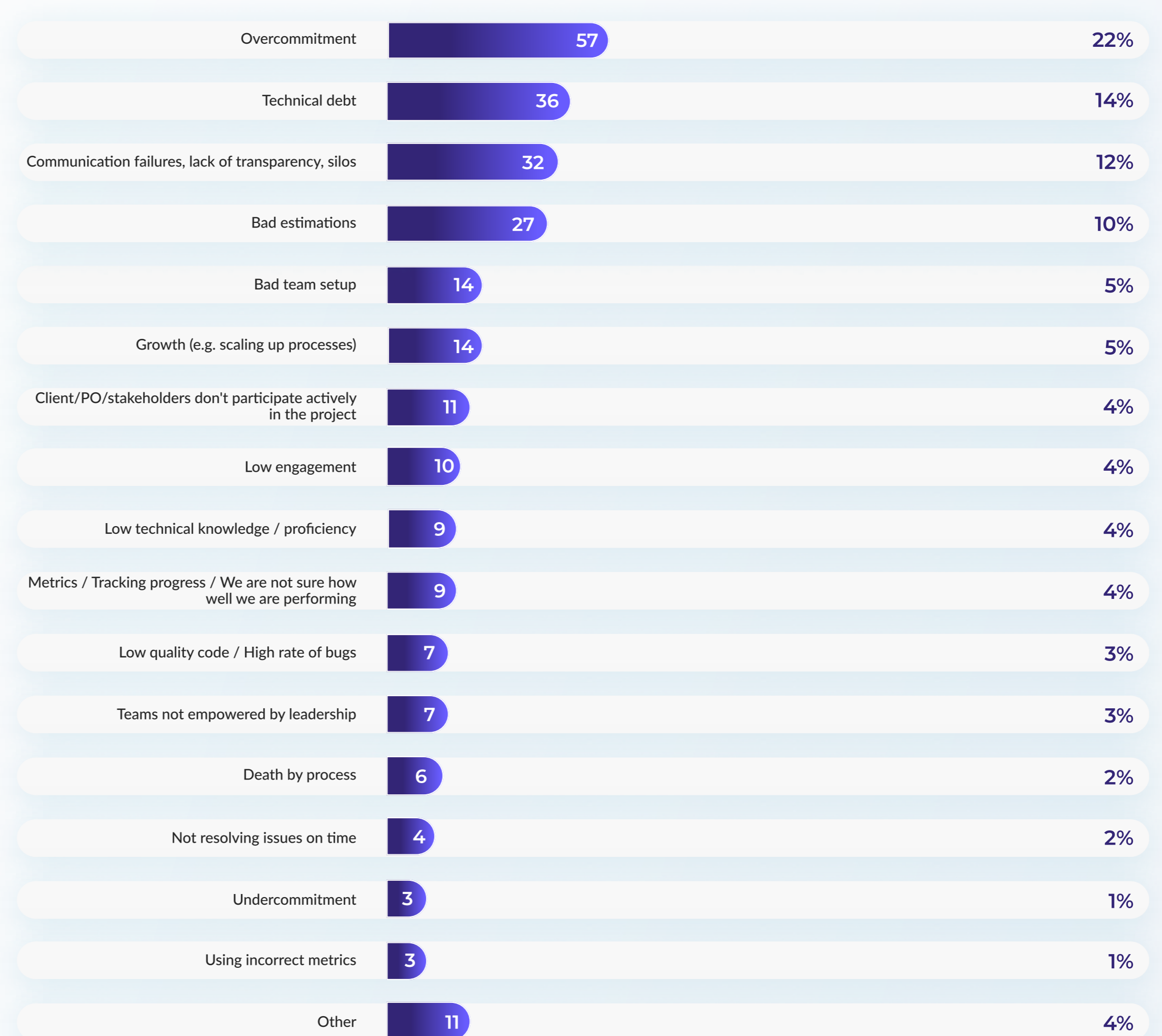
What are your biggest challenges right now?



Overcommitment – a key challenge for CTOs

Our survey found that a major challenge plaguing CTOs is overcommitment. Striving to balance ambitious goals with limited resources can lead to an overwhelming workload and hinder progress. Next, the dominant obstacles relate to effective product delivery. Managing technical debt is a major problem, as outdated or inefficient systems hinder innovation and stifle growth. Communication failures, lack of transparency and the presence of silos further compound the challenges of product delivery, requiring consistent efforts to foster collaboration and streamline operations. As CTOs navigate these complexities, finding the right balance between commitments and delivery capabilities remains a focal point of effective technology leadership.

What is the #1 cause of delivery problems for your team?



The top technology challenge for companies in the next 2 years: scaling up

In the context of technological challenges that lie ahead for companies in the next two years, the overwhelming consensus points towards scaling as the most prominent obstacle. The need to effectively manage and accommodate rapid growth while maintaining operational efficiency poses a considerable concern for businesses across various industries.

As companies strive to expand their market presence, handle increased demand, and stay ahead of the competition, scaling the technological infrastructure becomes critical. This entails scaling up not only the technology itself but also the teams, processes, and resources to ensure a seamless and sustainable growth trajectory.

What do you think is the single biggest technology challenge your company will need to overcome in the next 2 years?



Expert commentary

Sergei Dubograev

VICE PRESIDENT OF DEVELOPMENT AT CLUTCH

In the competitive tech landscape, CTOs face the dual challenge of attracting and retaining top talent and fostering a culture of innovation. Ensuring the company remains at the cutting edge necessitates an environment where the brightest minds feel valued and are given the tools and opportunities to innovate, keeping products, services, and technologies ahead of the competition. With new technologies and opportunities, the significance of ongoing education, culture management, and innovation becomes greater.



09

Self- development

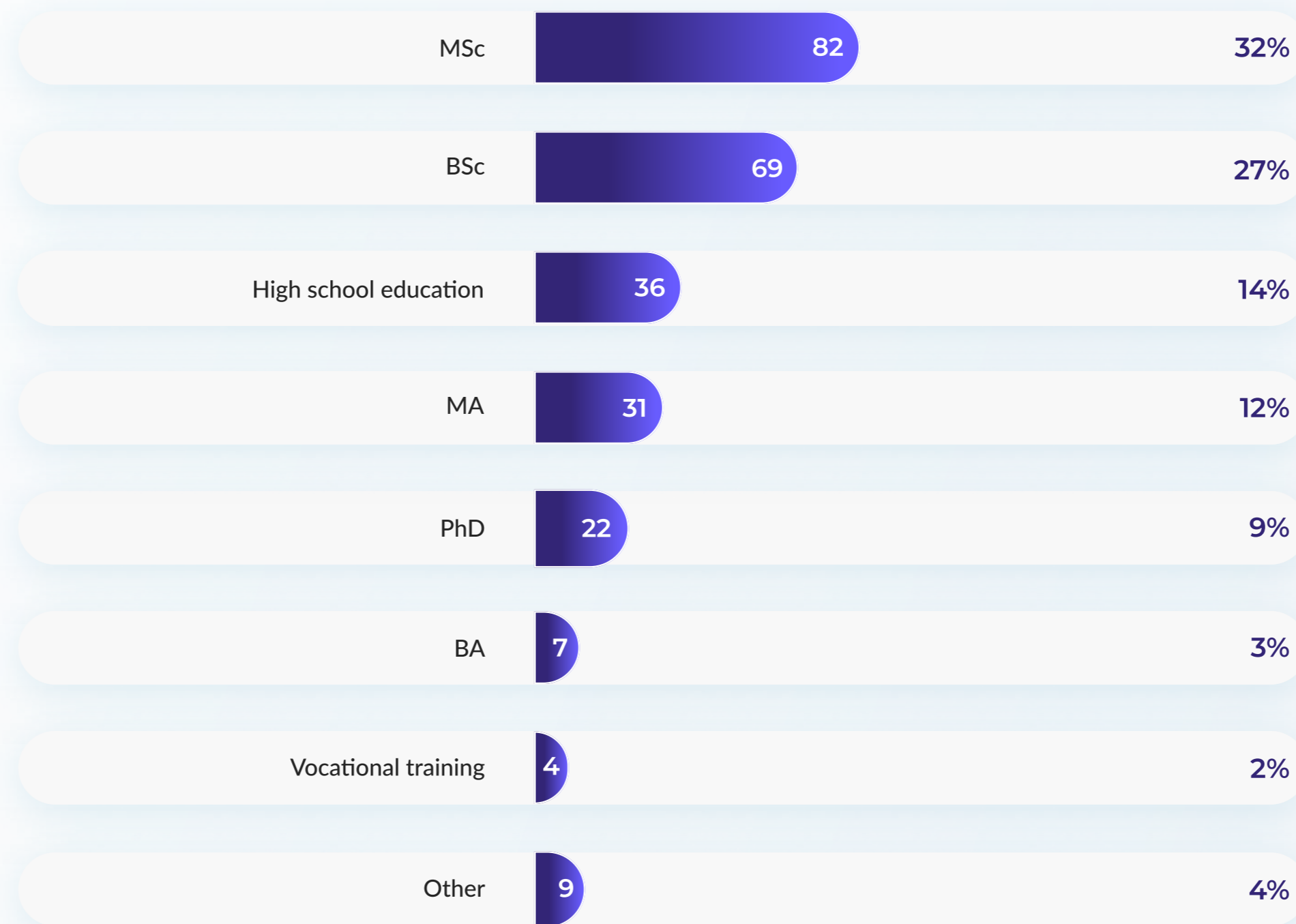
A look at CTOs' growth and
areas of improvement

BY STX NEXT

The vast majority of CTOs hold a degree or higher

The majority of CTOs exhibit a high level of education, with at least 83% holding a degree or higher. This data indicates a strong emphasis on academic qualifications within the CTO community. The prevalence of advanced degrees among CTOs underscores the importance of Continuous Learning and professional development in the ever-evolving world of technology and business.

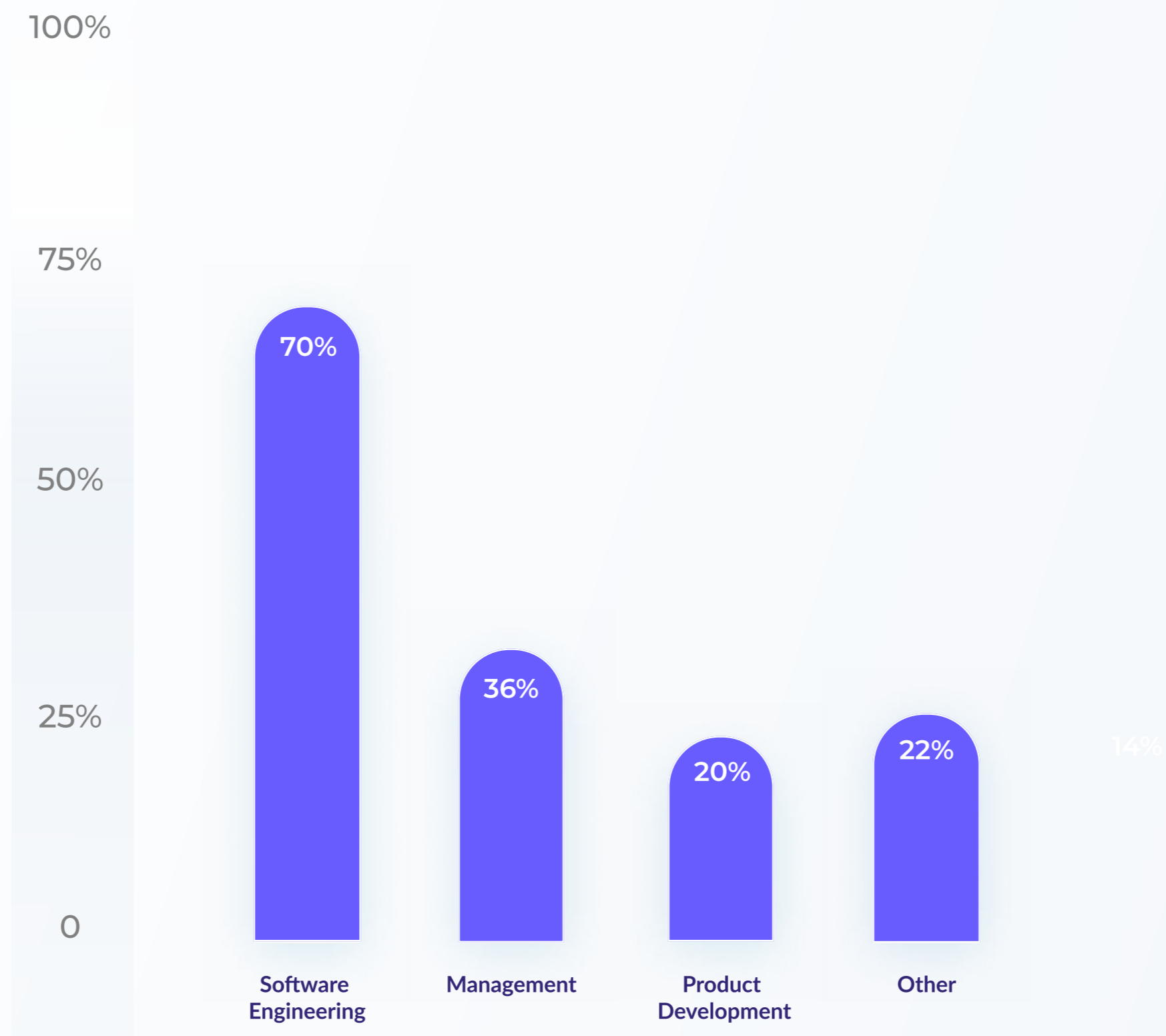
What is your current level of education?



From developer to leader: CTO Survey reveals strong technical backgrounds

Approximately 70% of respondents had prior experience as programmers or engineers before taking on the role of CTO. This data indicates that a significant portion of CTOs have a strong technical background, which contributes to their deep understanding of technology and its applications. Working in hands-on technical positions allows CTOs to bring valuable knowledge to leadership positions, leading teams with a practical and informed approach.

What field(s) is your qualification in?

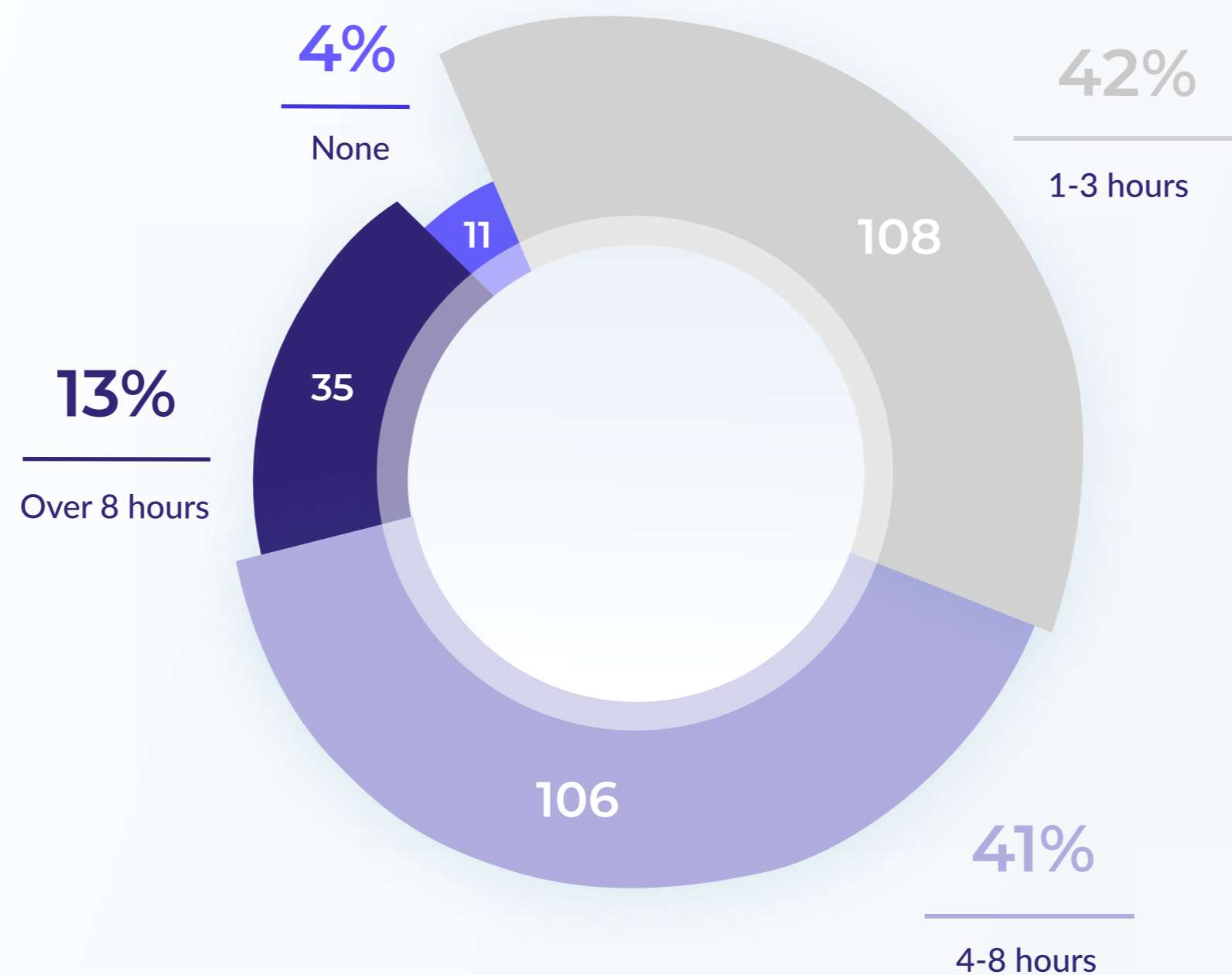


96% of CTOs dedicate time to education on a weekly basis (1/2)

The dedication to continuous education among CTOs is striking, with an impressive 96% of respondents devoting time to learning on a weekly basis. Such a high percentage reflects the CTO community's commitment to staying informed and evolving within the rapidly changing technology landscape.

Although only a small fraction (4%) claimed not to engage in weekly learning, the vast majority actively pursue knowledge and growth. While the exact timing of this education remains unspecified – whether it occurs during office hours or beyond work – the survey results highlight a clear preference for self-taught online training or courses.

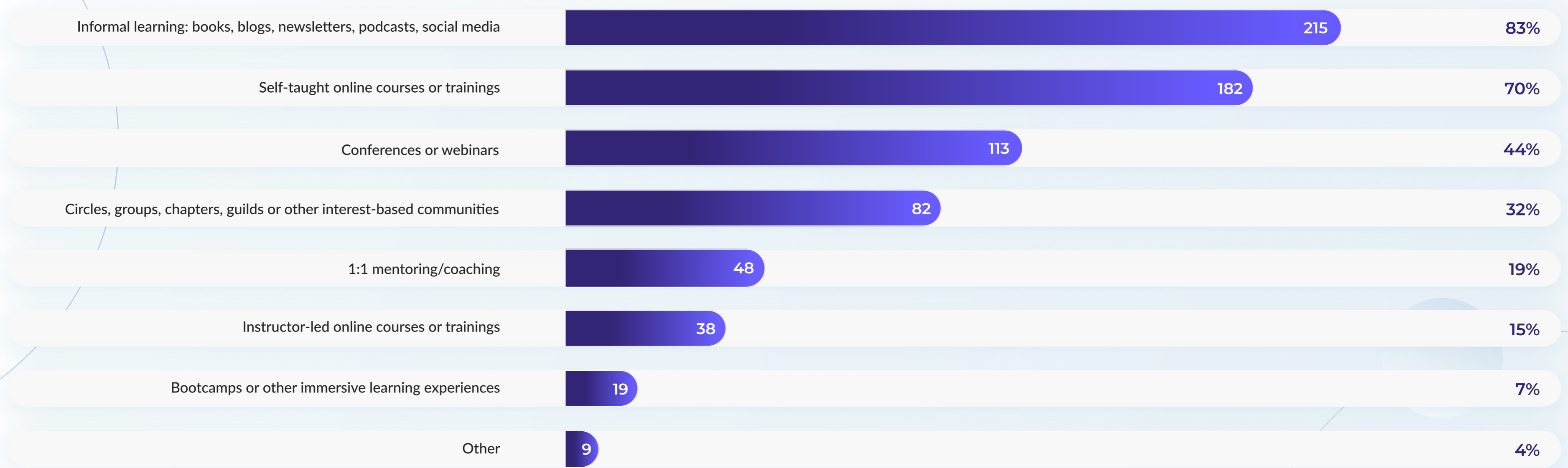
How much time do you spend on learning weekly?



96% of CTOs dedicate time to education on a weekly basis (2/2)

A significant 70% of CTOs embrace this flexible and accessible method to expand their skill set, keeping up with industry advancements and acquiring the expertise needed to drive innovation within their organizations.

How are you learning?



Leading by example: The areas CTOs want to improve

The survey reveals that 52% of CTOs recognize the importance of soft skills in fostering their team members' growth. Consequently, CTOs themselves seek to improve their soft skills as well. The two most significant areas for improvement identified were defining the long-term vision (30%) and managing people (29%). By enhancing their soft skills, CTOs aim to set a clear example for their teams, displaying effective leadership and guiding their members in the right direction. The survey respondents highlighted the value of leading by example, emphasizing the significance of strong soft skills in promoting cohesive and successful teams within their organizations.

Which of the following areas would you like to improve the most in?



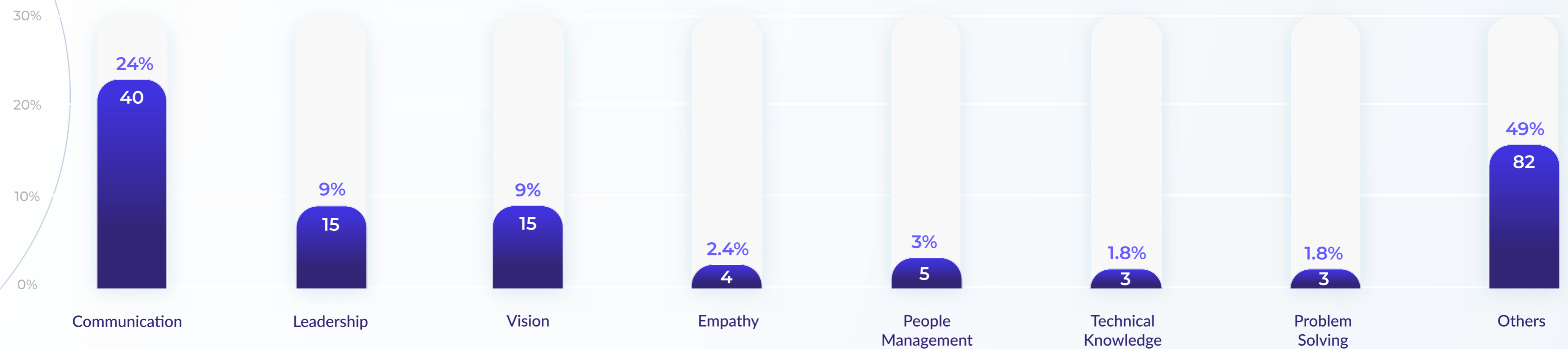
Communication is the most important skill for a successful CTO

Effective communication is the most important skill for a successful CTO. It has been repeatedly highlighted in various forms, emphasizing the importance of clear, transparent, and effective communication. This includes skillful communication with different stakeholders, teams, and departments and the ability to express complex technical concepts to non-technical people.

Among the most important skills identified by CTOs was leadership. CTOs emphasize the great importance of leadership qualities, which include being a leader, empowering team members, supporting professional development, and driving technical strategy.

In addition to effective communication and leadership, vision is identified as one of the most important capabilities for a successful CTO, as it involves shaping a clear and inspiring technological direction for the organization's future.

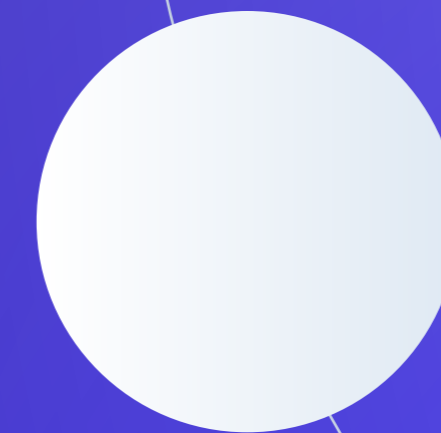
What is the most important skill for a successful CTO, in your opinion?



10

Satisfaction

How satisfied are CTOs
with their jobs, teams,
and software velocity

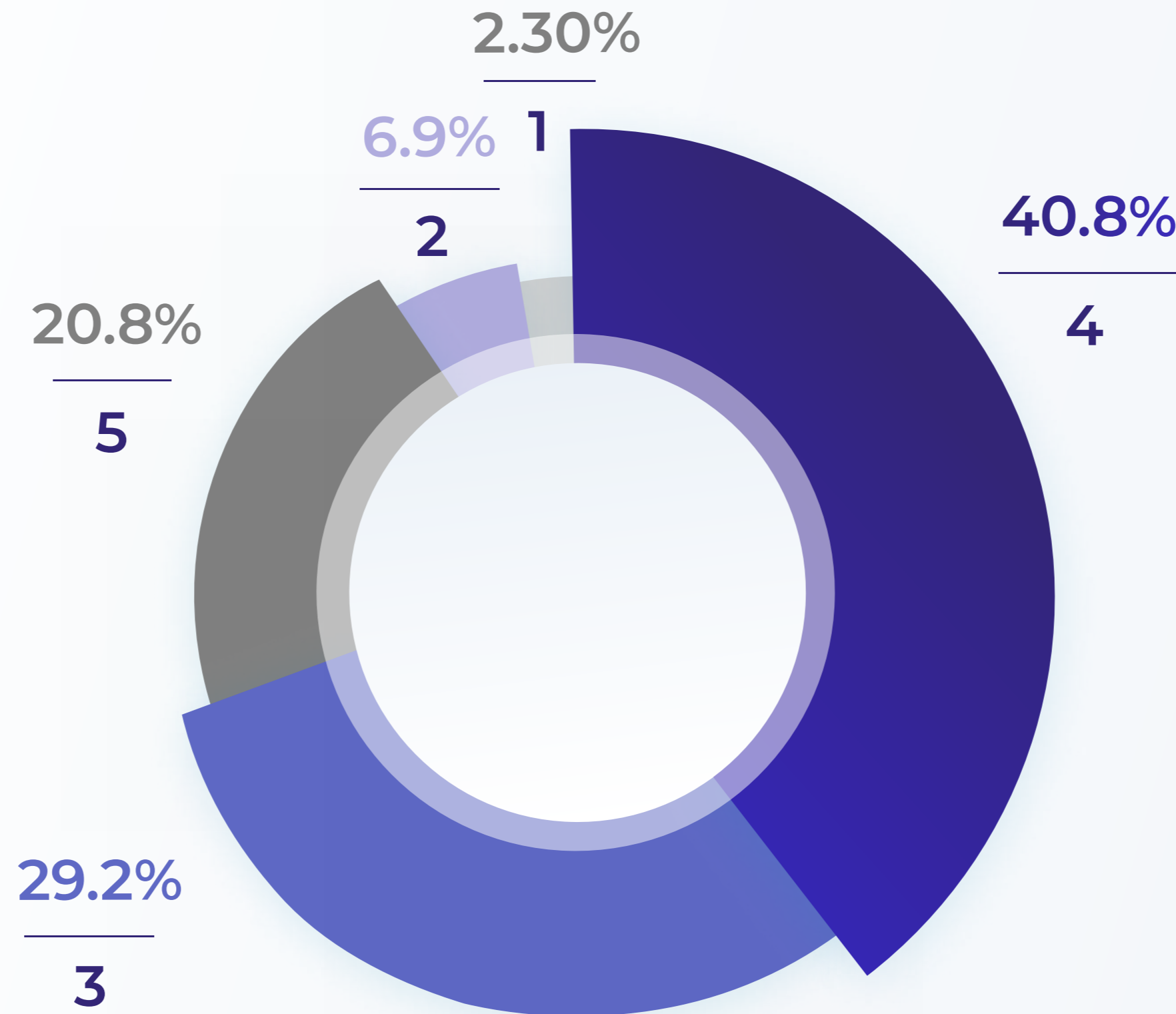


Overall satisfaction remains high but with a slight decline (1/2)

Job satisfaction is generally high among CTOs in the survey; the average rating is 3.7 out of 5, which is a drop-down from the previous edition (4.1 out of 5).

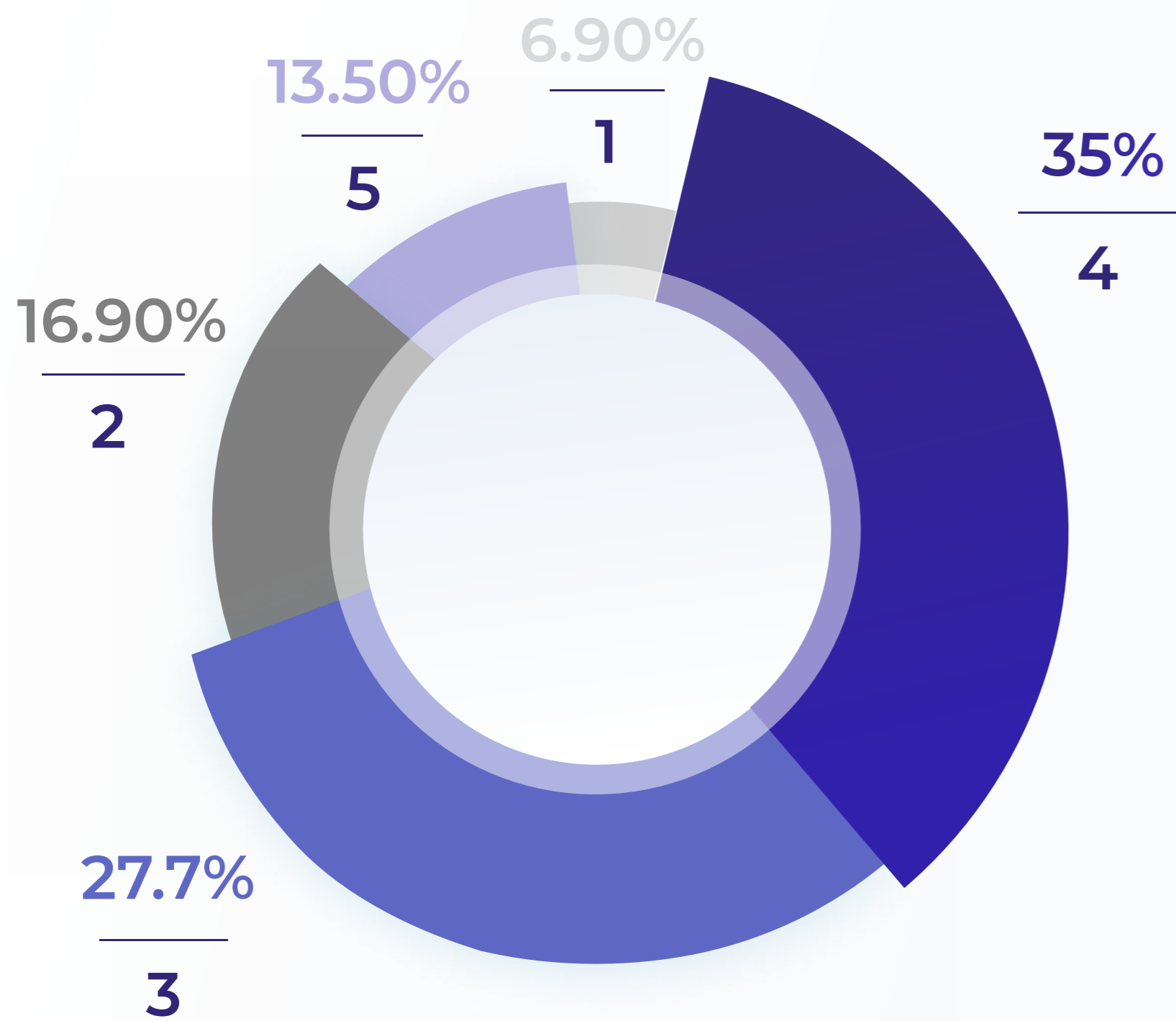
Salary satisfaction does not rate as highly as job satisfaction. Although, with an average rating of 3.31 out of 5, CTOs generally lean more towards feeling satisfied with their salary.

How satisfied are you with your job overall?

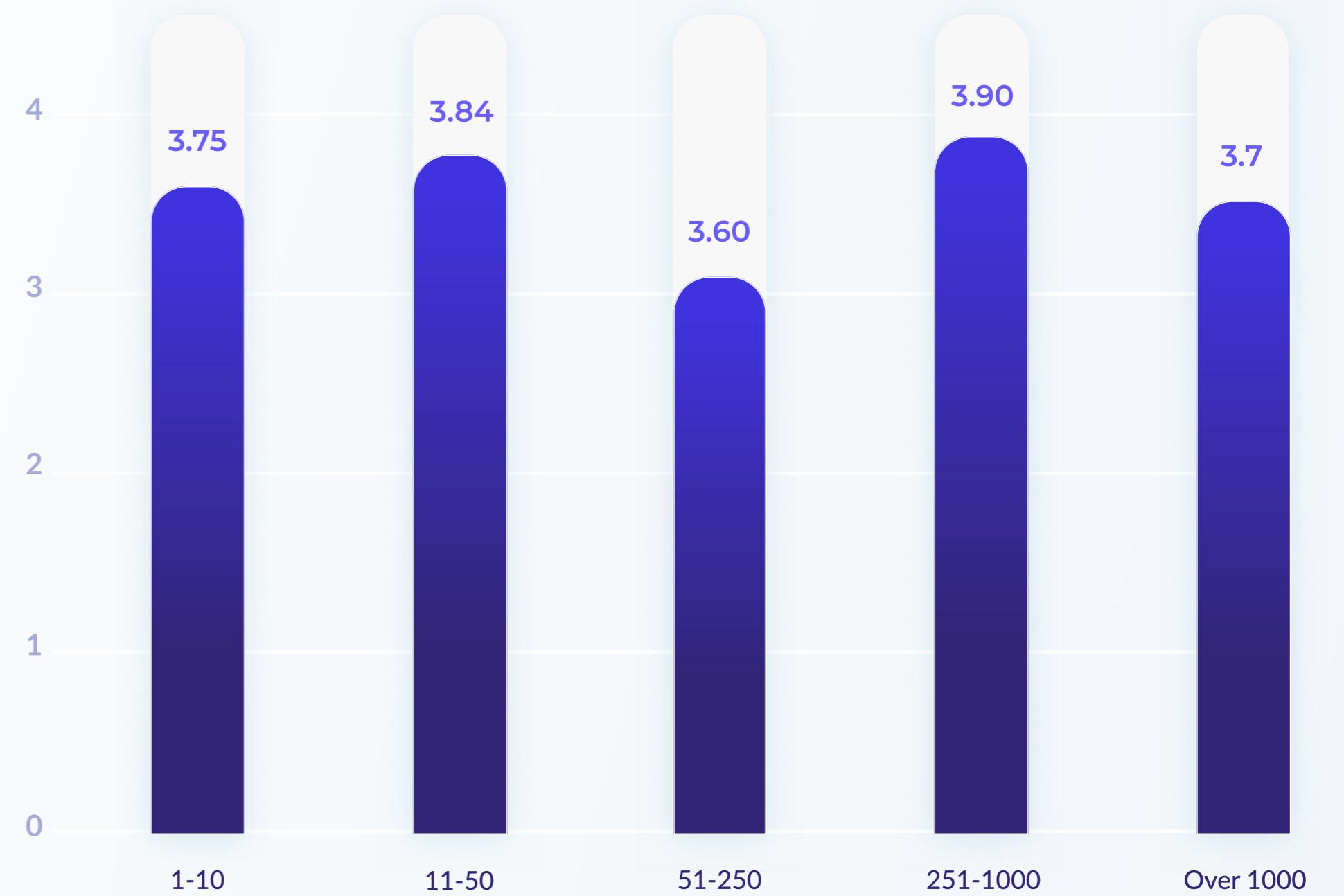


Overall satisfaction remains high but with a slight decline (2/2)

How satisfied are you with your salary?



Job satisfaction overall vs company size

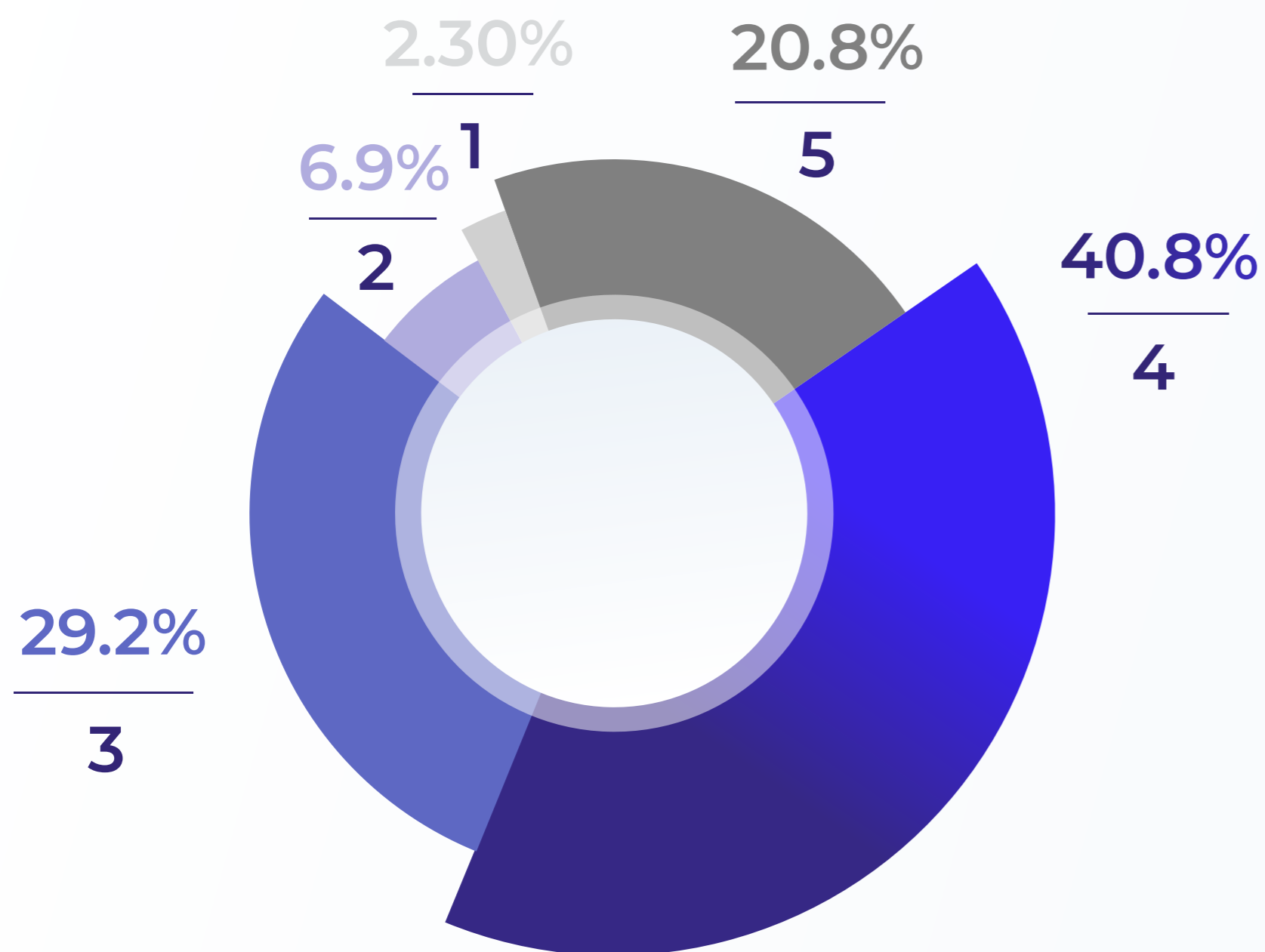


CTO team satisfaction: Promising trends with room for growth

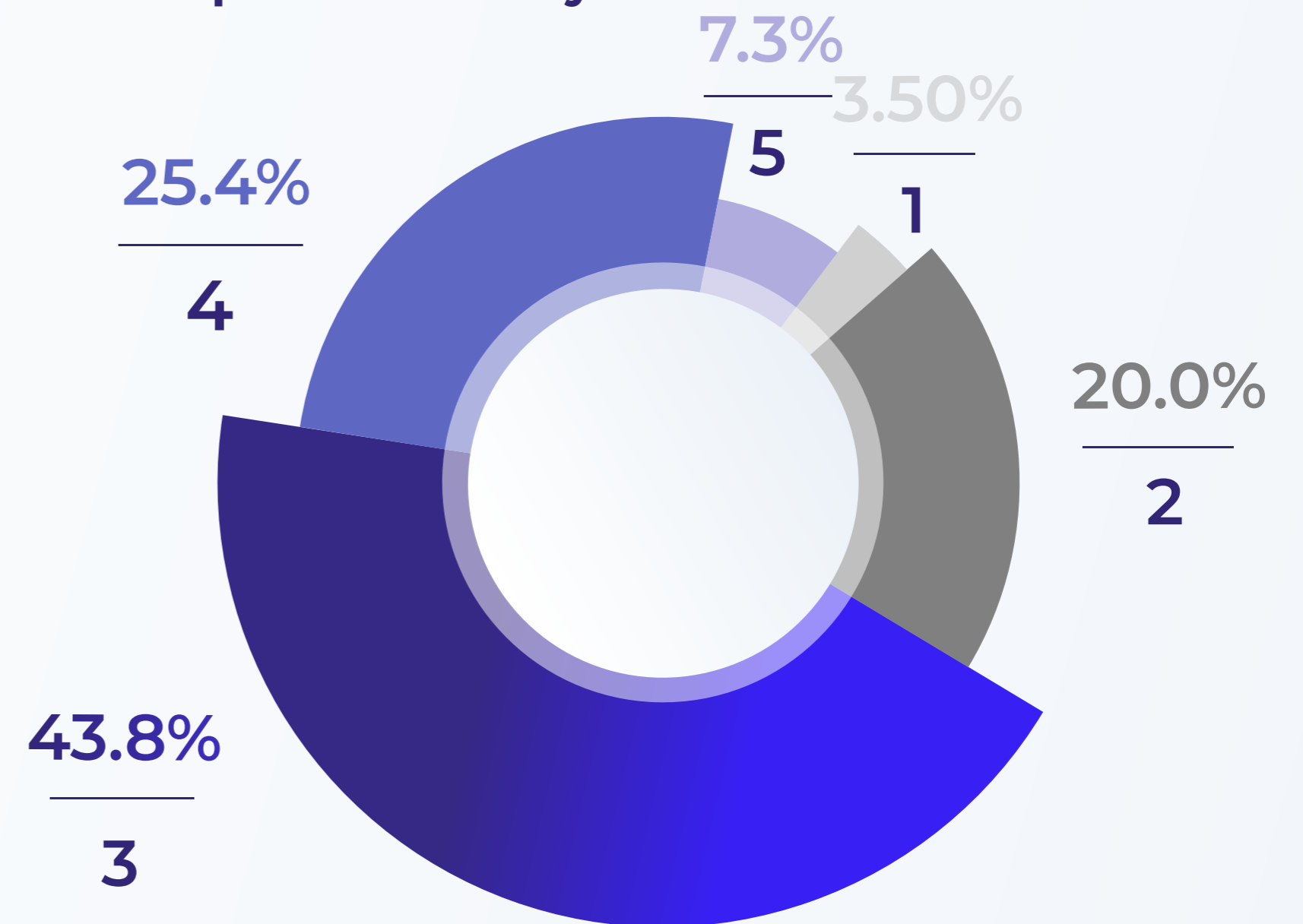
Initial observations give a mostly positive outlook, with the vast majority of CTOs expressing satisfaction with their teams. Dissatisfaction is relatively low, reflecting the overall strength of CTO team dynamics. It is noteworthy, however, that almost 80% of CTOs did not say they were fully satisfied, indicating that there is room for growth and improvement in team dynamics. The average satisfaction rating for the team is 3.7 out of 5, indicating a solid foundation for progress.

The survey emphasized various crucial factors contributing to overall team satisfaction, encompassing performance, culture fit, attitude, and technical skills. Interestingly, the satisfaction rating takes a dip when focusing on team performance, pointing to an area that warrants attention and improvement. For instance, a CTO might express satisfaction with their team while still feeling concerned about software development velocity, signifying an opportunity to boost productivity in this aspect. Consequently, software development velocity emerges as a vital aspect with significant potential for growth and refinement. Through a deeper exploration of these insights, organizations can proactively address areas of improvement and foster an even more satisfying work environment for CTOs and their teams.

How satisfied are you with your team?



How satisfied are you with your software development velocity?

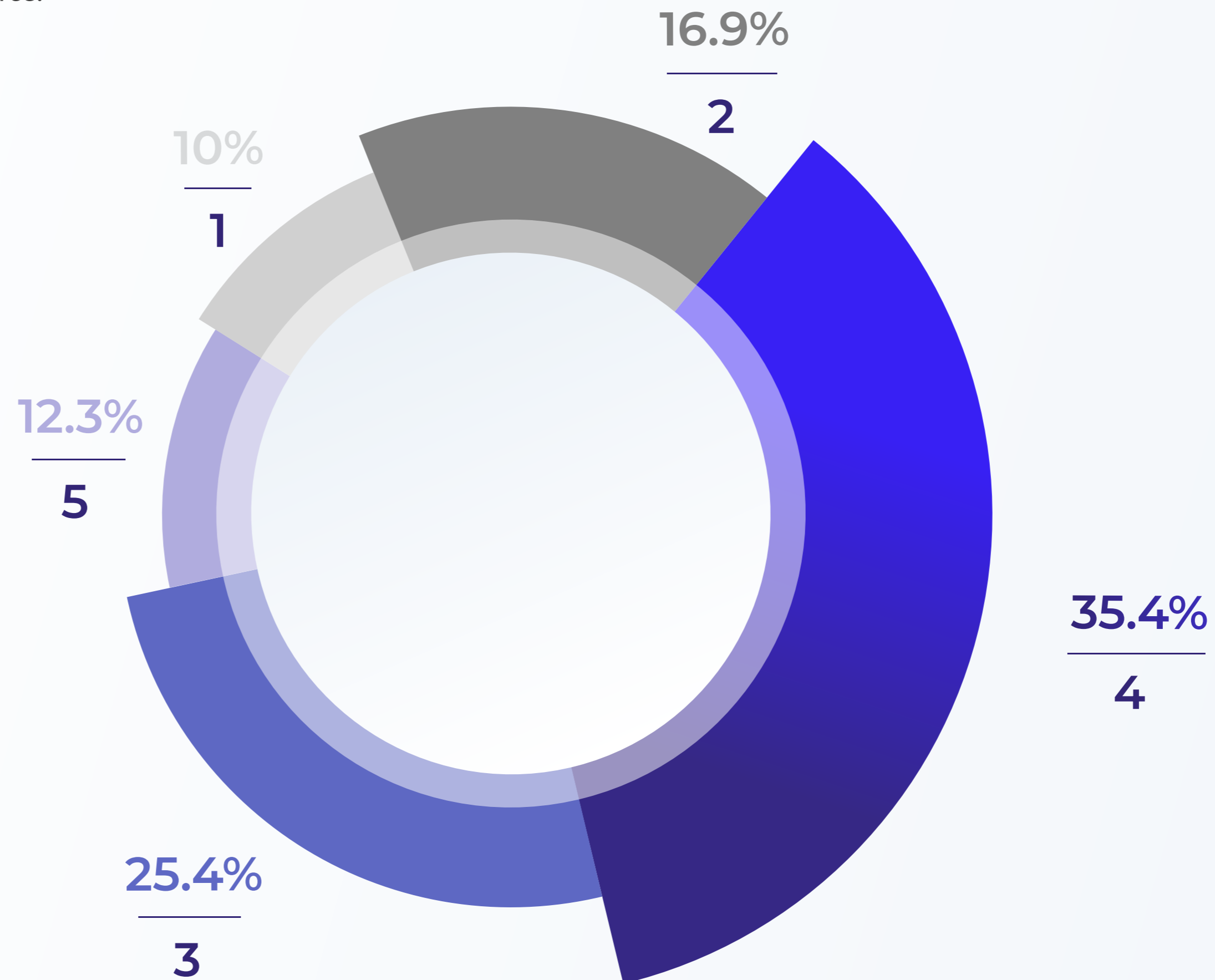


CTO striking a balance among different perspectives

The survey on work-life balance satisfaction revealed a diverse range of perspectives, with respondents distributed across various satisfaction levels. While a substantial portion expressed moderate to high levels of contentment (ratings 3 to 5), there were also notable proportions indicating room for improvement in achieving a better work-life balance (ratings 1 and 2).

Overall, the survey reflects a diverse distribution of satisfaction levels, emphasizing the need for organizations and individuals to address work-life balance to ensure the well-being and productivity of their workforce.

How satisfied are you with your work-life balance?

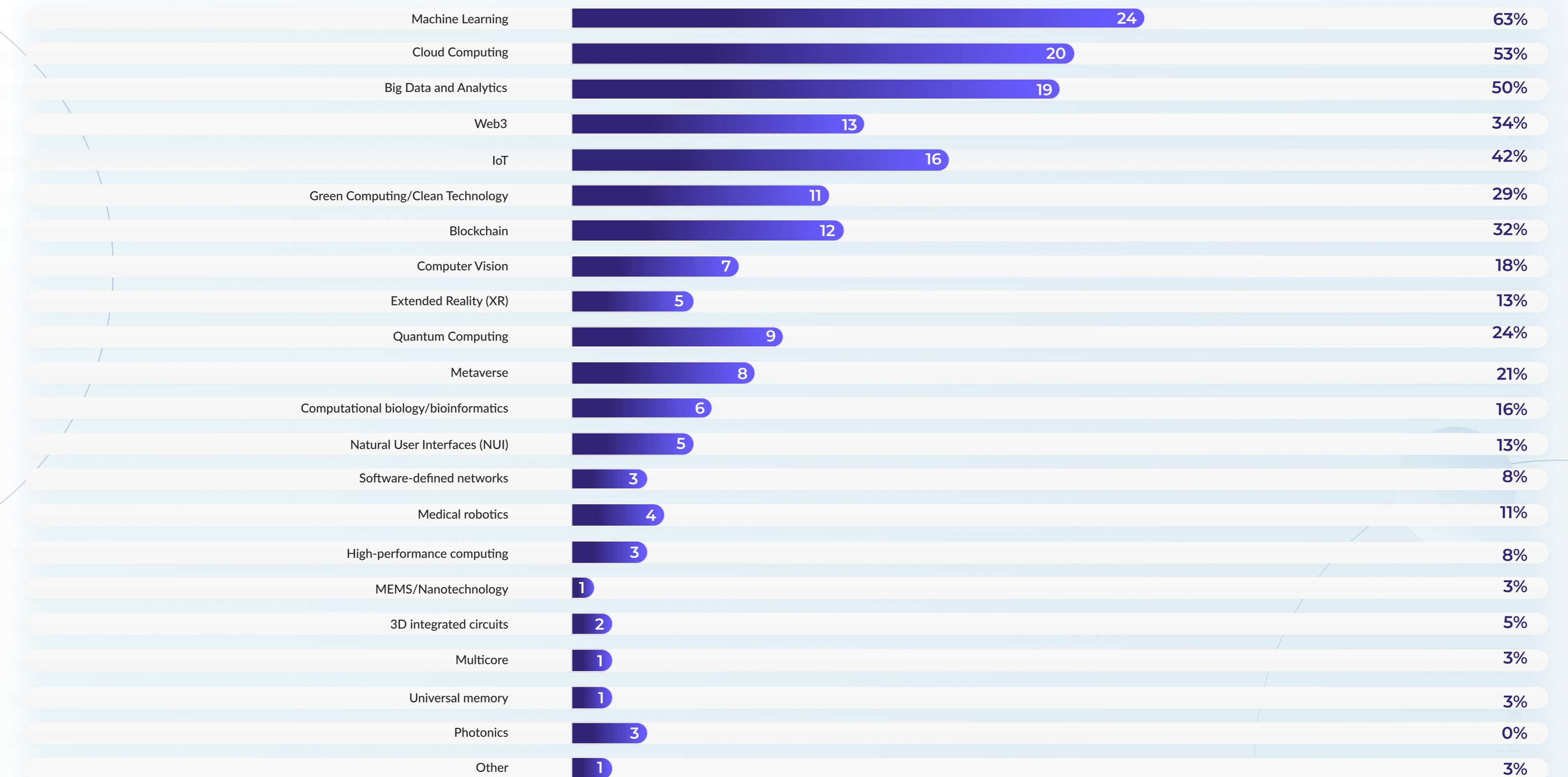


FinTech CTOs take on technology, security and future challenges

FinTech CTOs are embracing Machine Learning as the leading technology (1/2)

In the rapidly evolving landscape of FinTech, CTOs are keenly aware of the technologies that will shape the industry in the next 2-4 years. According to the survey, a staggering 63% of FinTech CTOs believe that Machine Learning will take the lead as the most popular technology during this period. Following closely behind, Cloud Computing has garnered the confidence of 53% of CTOs, while Big Data and Analytics stand at 50%.

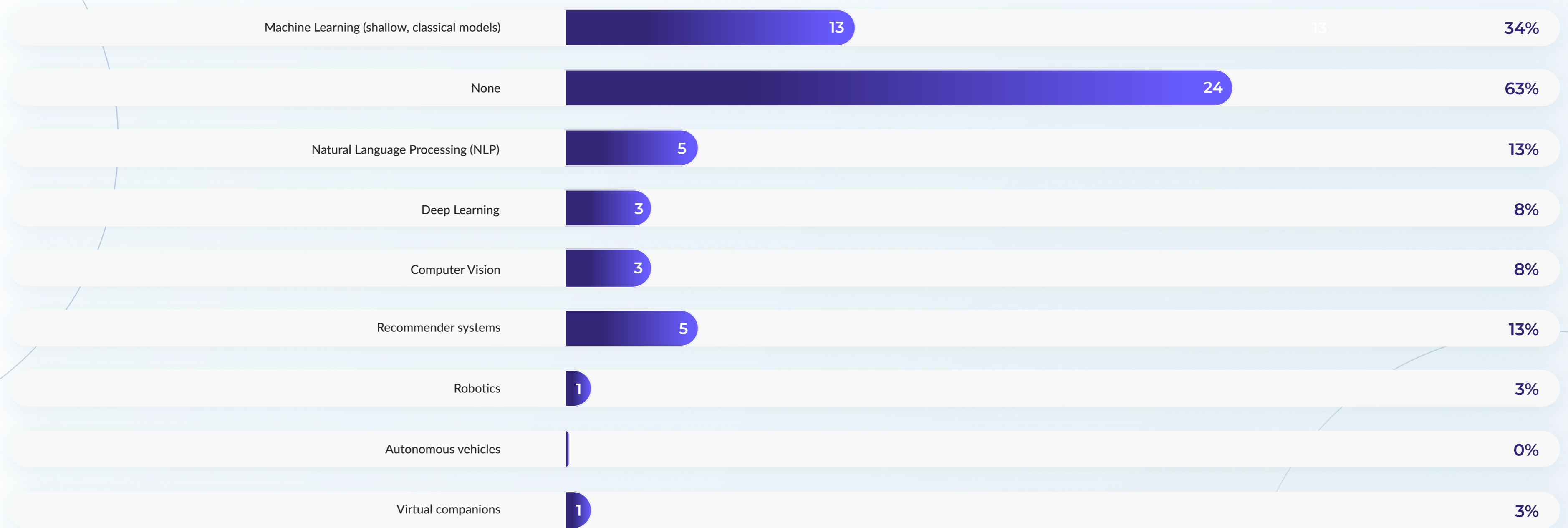
Which technologies and trends do you think will become much more prominent in the next 2-4 years?



FinTech CTOs are embracing Machine Learning as the leading technology (2/2)

Despite the promising future of Machine Learning, the majority of FinTech CTOs, accounting for 63%, have not yet implemented any AI technologies. However, 34% of them have already embraced Machine Learning, showcasing its growing significance and potential in reshaping the FinTech landscape.

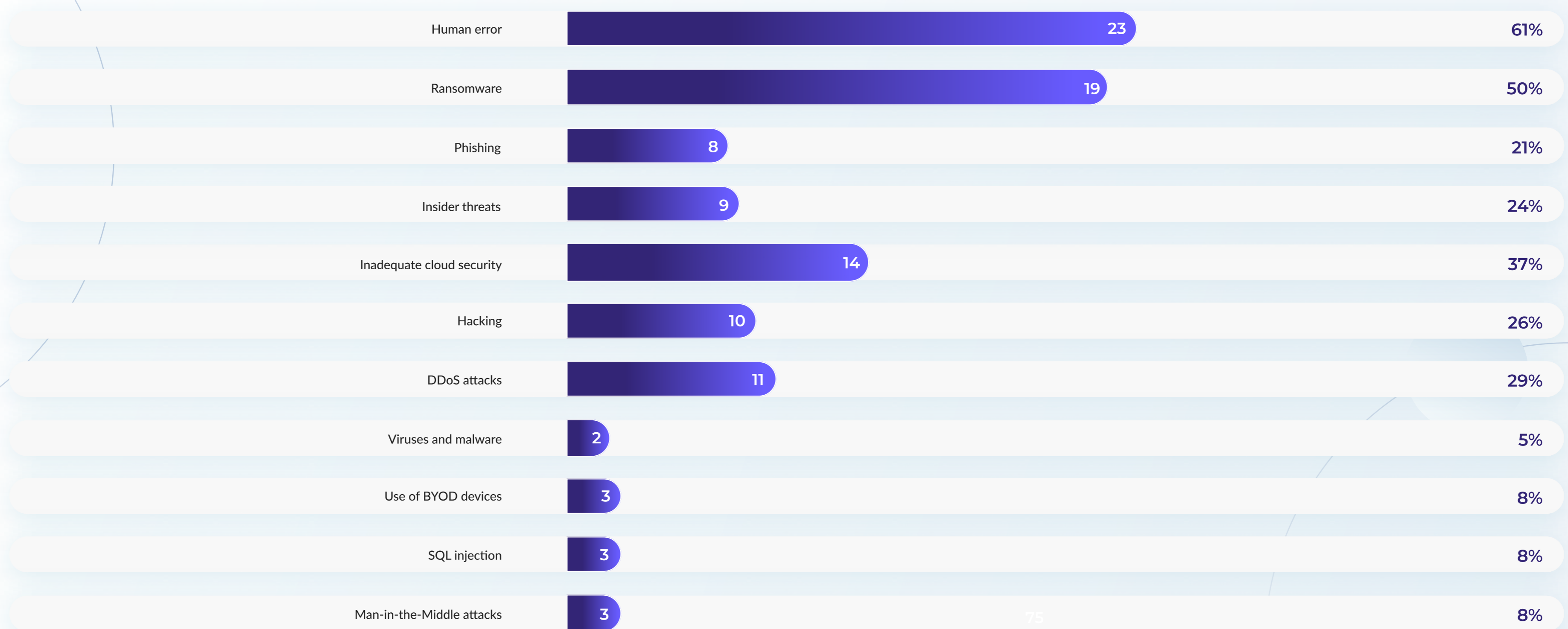
Which AI technologies have you implemented?



Human Error is the top cybersecurity threat faced by 61% of FinTech CTOs

In the dynamic world of FinTech, cybersecurity remains a paramount concern for CTOs. The survey reveals that 61% of FinTech CTOs identify human error as the most significant cybersecurity threat facing their organizations. This finding underscores the critical role of employee training and awareness in bolstering overall security measures. Following closely behind, 50% of CTOs express concern over the rising menace of ransomware, a type of malicious software that can disrupt operations and hold sensitive data hostage. Additionally, phishing, a deceptive tactic aimed at stealing valuable information, is flagged as a prominent threat by 21% of the CTOs.

Which of the following do you consider the biggest cybersecurity threats?



Key factors influencing FinTech venture success: Quality of deliverables & feedback from peers

FinTech leaders unanimously agree on two critical factors when evaluating the performance of their team members. First and foremost, an overwhelming 89% of FinTech CTOs emphasize the significance of the quality of deliverables, encompassing both features and code. In an industry that demands precision and innovation, the ability to consistently produce high-quality output is vital for driving customer satisfaction and gaining a competitive edge.

Additionally, 82% of CTOs highlight the importance of feedback from peers concerning soft skills, such as teamwork, communication, and adaptability. These intangible but indispensable qualities play a pivotal role in fostering a collaborative and harmonious work environment, leading to improved productivity and enriched employee experiences.

When you measure the performance of your team members, which of the following influence your assessment?



FinTech CTOs encounter a diverse range of challenges that demand adept problem-solving and strategic thinking

In the fast-paced world of FinTech, CTOs are facing key challenges that demand attention. The survey reveals that 37% of them grapple with technical debt and refactoring for scalable technology infrastructure, 32% encounter hiring difficulties in the competitive talent market, and 29% prioritize cybersecurity to protect financial data and maintain trust. These insights highlight crucial areas where strategic solutions and innovation are needed to drive industry growth and resilience.

What are your biggest challenges right now?



Expert commentary

Iulia Kopczyński

DELIVERY MANAGER AT STX NEXT (FINTECH)

Our observations show that current FinTech customers are increasingly interested in Data Engineering and Machine Learning, showing great enthusiasm when they propose us to attend workshops. Such discovery workshops help them, on the one hand, to better understand their requirements, and on the other hand, to understand our capabilities and how we can make it happen for them!



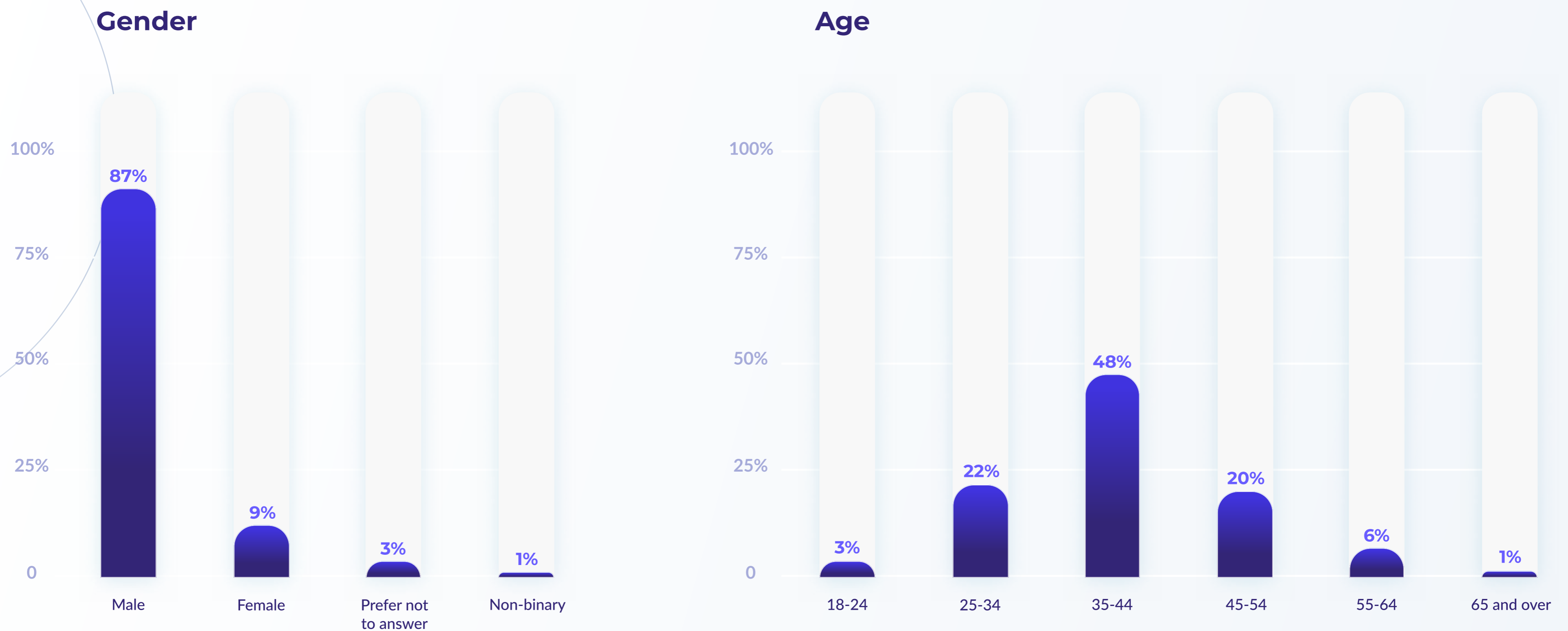
Demographics and firmographics

Who were the individuals and organizations that made this survey possible?

CTO roles: Uncovering the gender gap

This year's survey on CTO roles and gender representation reveals a disparity that needs attention. Since the vast majority of respondents were men, the survey results raise questions about the overall integration and gender balance in the technology industry. While the percentage of women in the tech industry is growing, the data paints a clear picture of their underrepresentation in CTO positions.

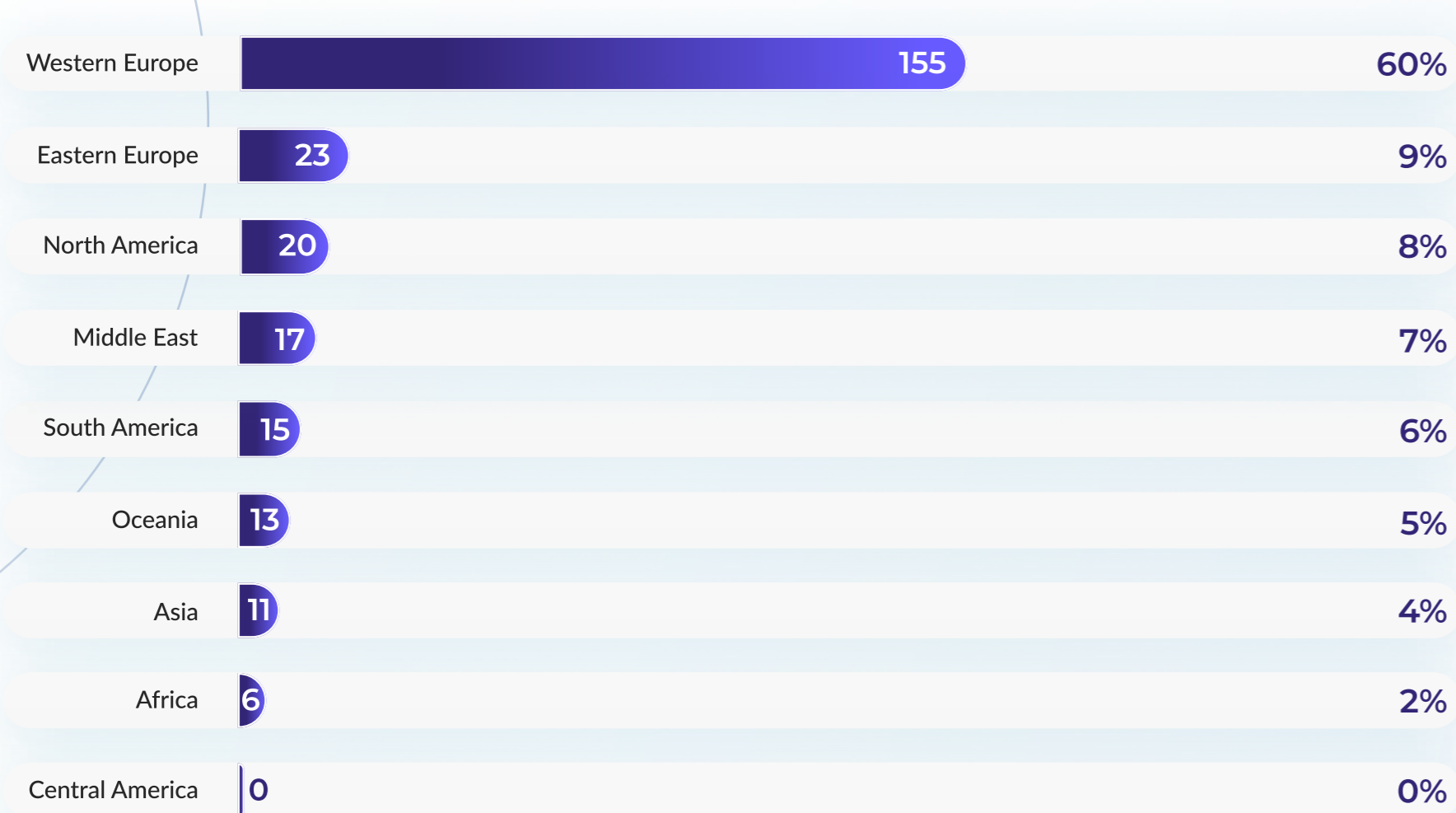
Amid a technology landscape where innovation knows no boundaries, it becomes clear that barriers persist, making it difficult for women to achieve leadership roles in significant numbers. In addition, the survey highlights that the majority of CTOs are between the ages of 35 and 44, further intriguing the dynamics of leadership and experience in the field.



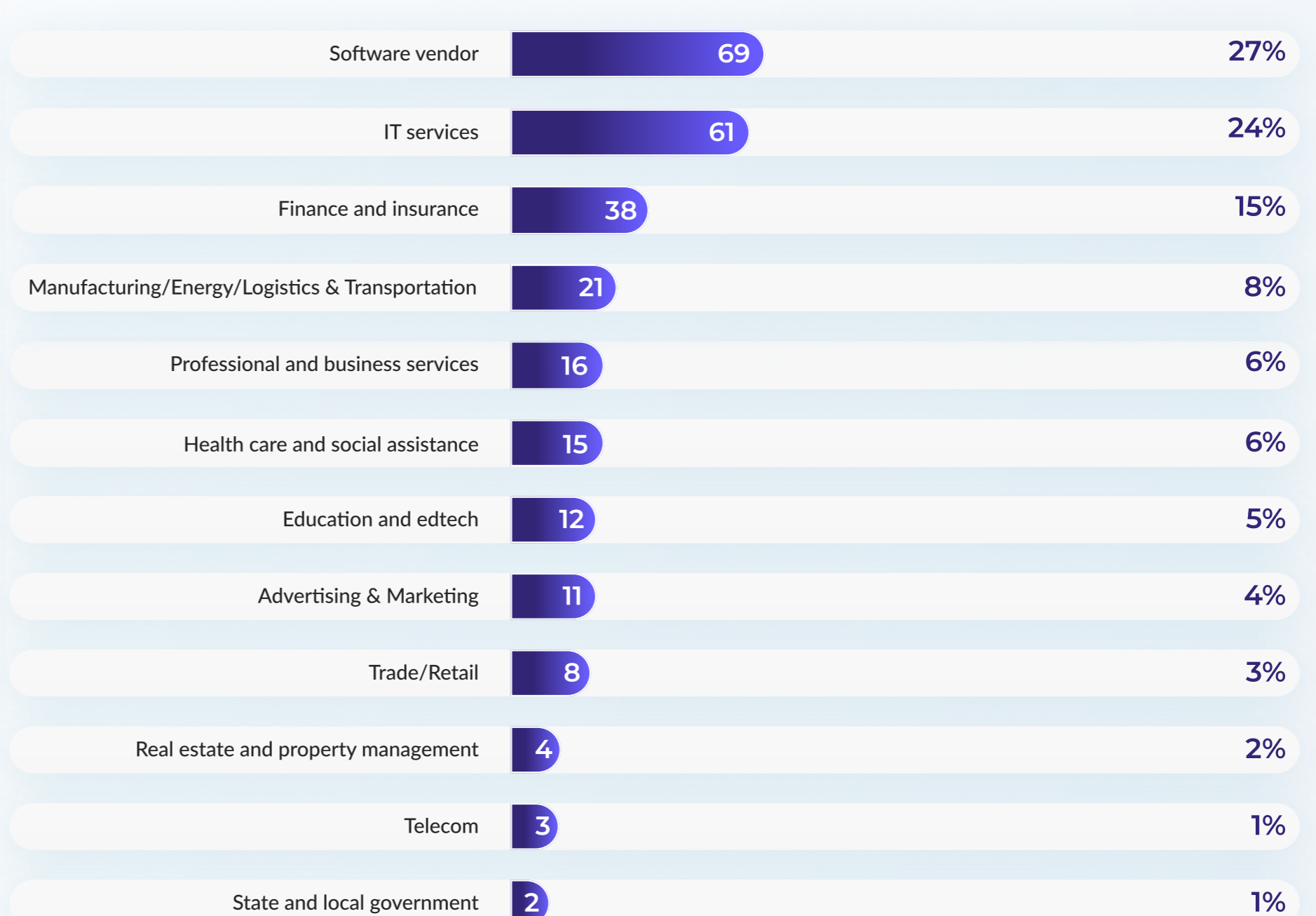
Dominant presence: Europe and IT/software industry lead the way

This year's survey showcases a striking trend of strong representation from Europe and the IT/software industry, making their mark as standout contributors. With a significant 69% of respondents hailing from the European continent, Western Europe emerges as the primary epicenter, accounting for an impressive 60% of the total respondents. Moreover, for the third consecutive year, the IT/software industry continues to hold sway, commanding a substantial 52% of participants. Notably, finance and insurance secure their position as the third most well-represented industries with a notable 15%. The survey's results demonstrate a powerful alignment of Europe's influence and the thriving IT/software sector, reflecting the ongoing prominence and growth in these domains.

Geographic region



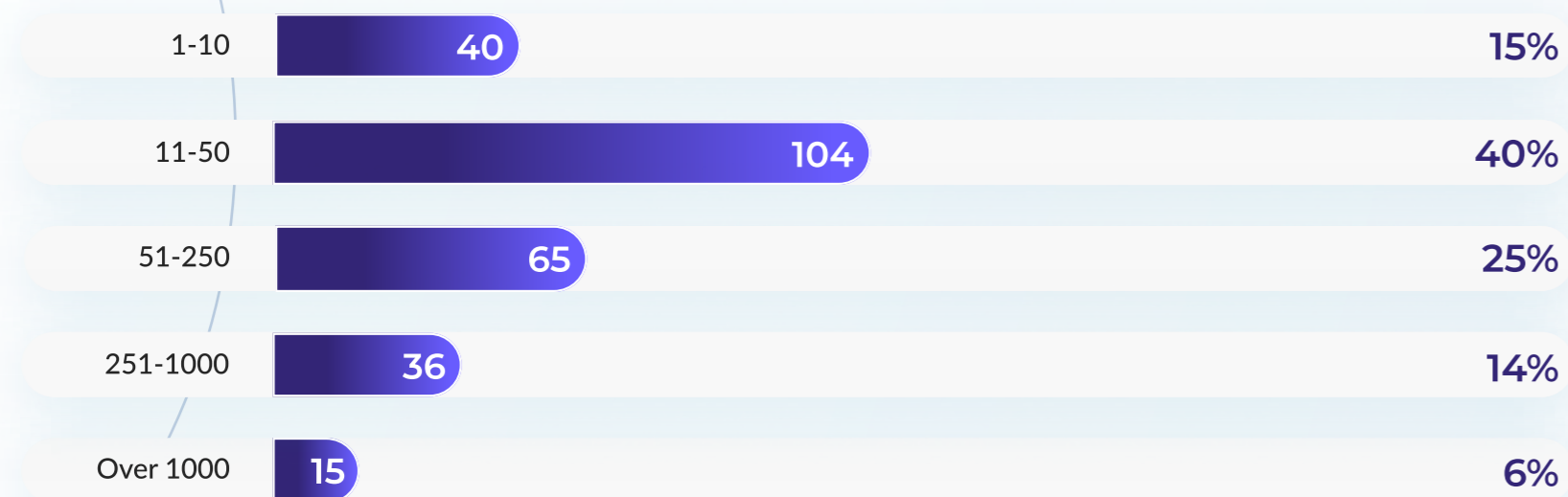
Industry



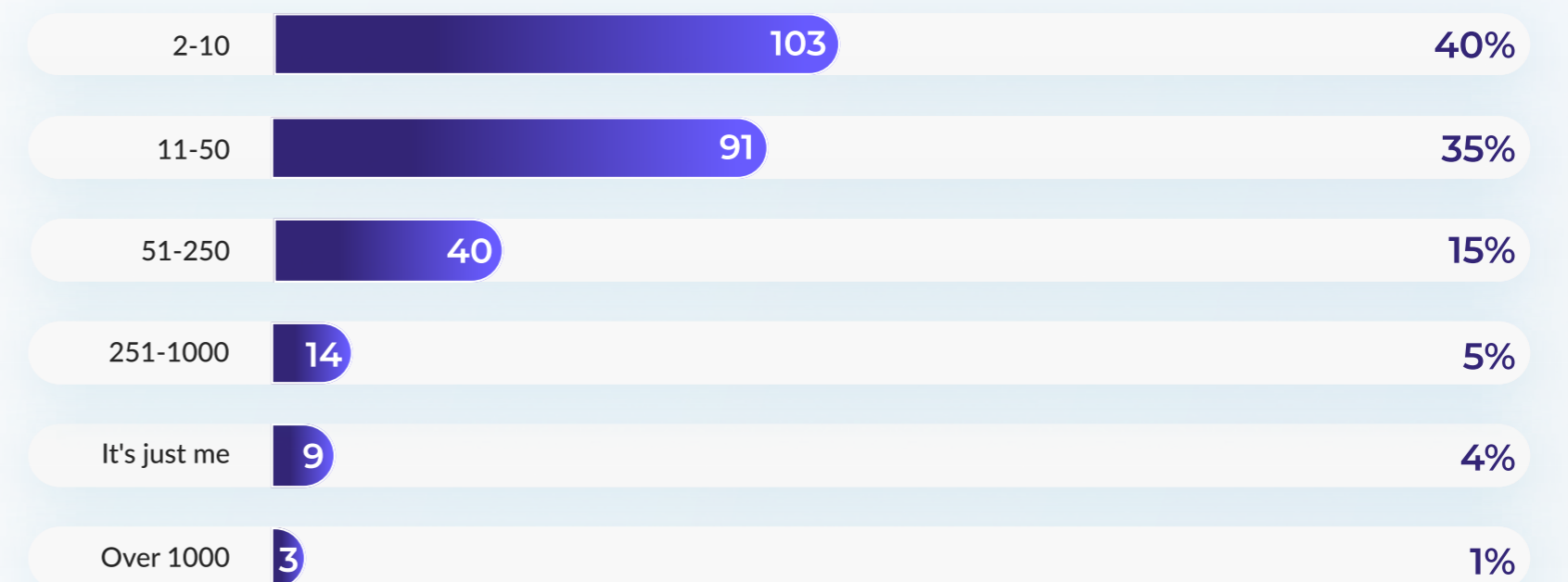
The majority of respondents' companies employ a high percentage of IT staff and dedicate a huge amount of their budget to IT

The vast majority of respondents' companies are entering the digital age, employing a significant number of IT staff and allocating large IT budgets. 75% of the CTOs surveyed work in companies with up to 30 IT employees, indicating a strong technology-focused workforce. Moreover, the survey highlighted that about 30% of participants belong to organizations that allocate more than 45% of their total budget to IT, highlighting the strategic importance of technological advances and digital transformation. These results indicate a clear commitment to using technology as a driver of innovation and growth among the companies surveyed.

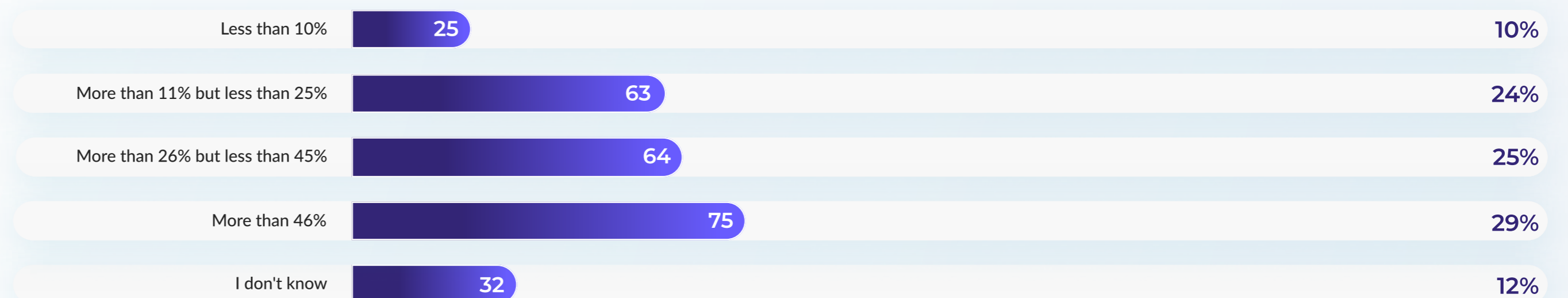
What is the total estimated number of employees working at your organization?



What is the total estimated number of IT staff working at your organization?



What is the percentage of your overall company budget earmarked for IT?



Credits & acknowledgments

The partners who helped
make the survey a reality

A huge thank you to all our partners

The Global CTO Survey 2023 was made possible with the support of our partners. We would like to show our appreciation to everyone who shared insight through expert commentary, helped to promote and publicize the survey, and offered promotions to our survey respondents.

STRATEGIC PARTNER



About STX Next

STX Next is a global IT consulting and AI company committed to providing exceptional digital services. Since 2005, we have been assisting clients from a wide range of market segments like FinTech, MedTech, AdTech, and others in their digital transformation activities.

We cooperate with over 500 dedicated Agile professionals, priding themselves on results and innovation-driven processes confirmed by a large number of international customers including leading global corporations, small and medium enterprises, and the most innovative start-ups.

Benefiting from our exceptional Python Heritage, STX Next has a proven track record of digital projects based on various technologies like Node.js, .NET, JavaScript, and implementing solutions using Data Engineering, Artificial Intelligence, Machine Learning, Cloud, and UX/UI.

To hire us for your project, visit stxnext.com

750+

**Software
Projects
Delivered**

300+

**Clients
Worldwide**

18+

**Years Of
Experience**

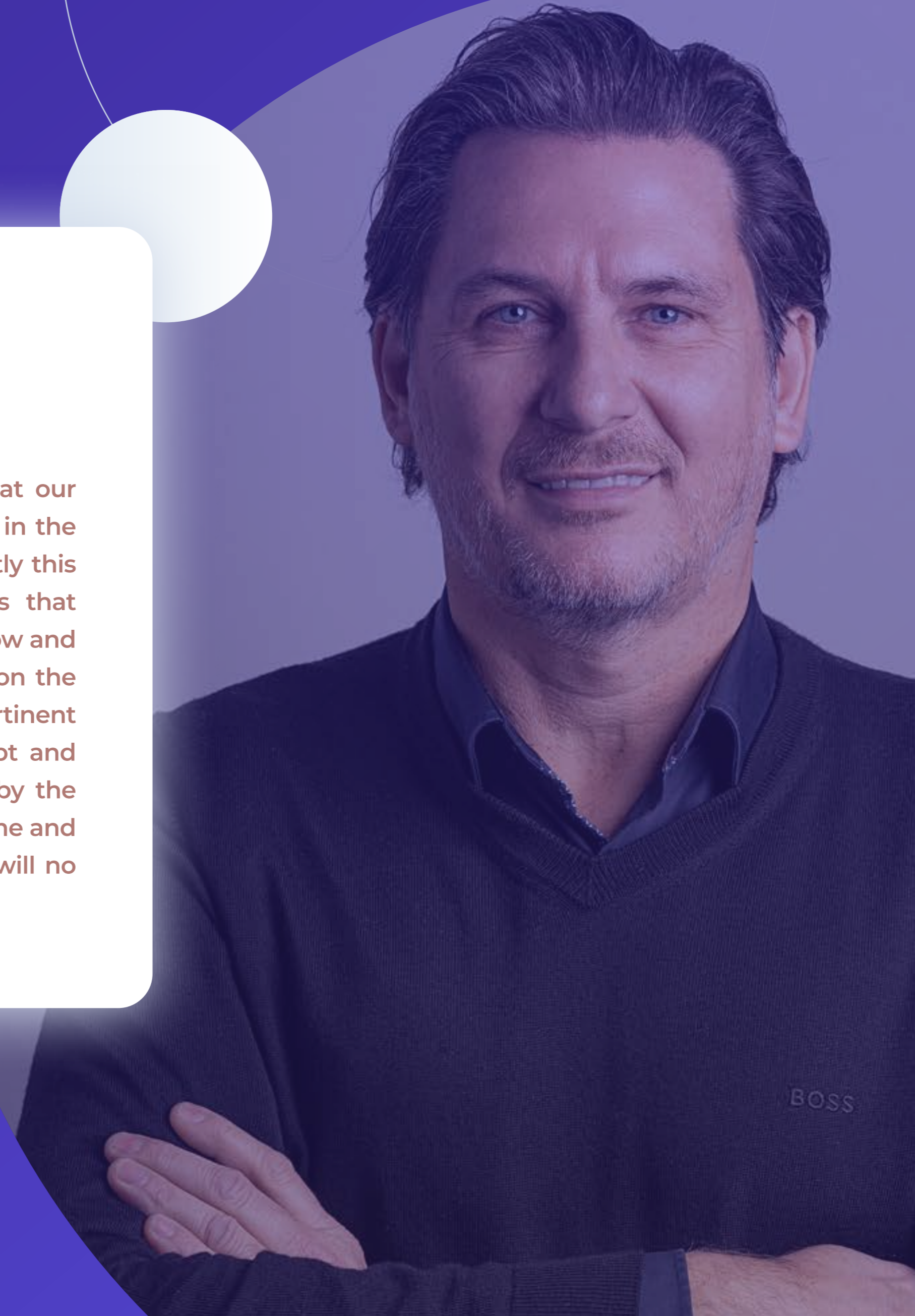


Expert commentary

Ronald Binkofski

CEO AT STX NEXT

As we delve into the insights and trends of the tech world, it's evident that our industry continues evolving at an unprecedented pace. Just as we observed in the previous year, the challenges facing CTOs continue to transform. Consequently this year another landscape shift appears on the horizon. Our survey shows that economic uncertainty has placed added pressure on businesses looking to grow and succeed. The skills shortage in the technology industry that has long been on the minds of leaders continues to place pressure on teams. This is particularly pertinent given the persistent danger of cyberattacks. Overwhelmingly, technical debt and refactoring are the most pressing concerns for CTOs, perhaps brought on by the skills shortage leading to sub-optimal solutions being implemented to save time and money. Although driven by necessity in many cases, these short-term fixes will no doubt place strain on businesses as they require more work in the long run.

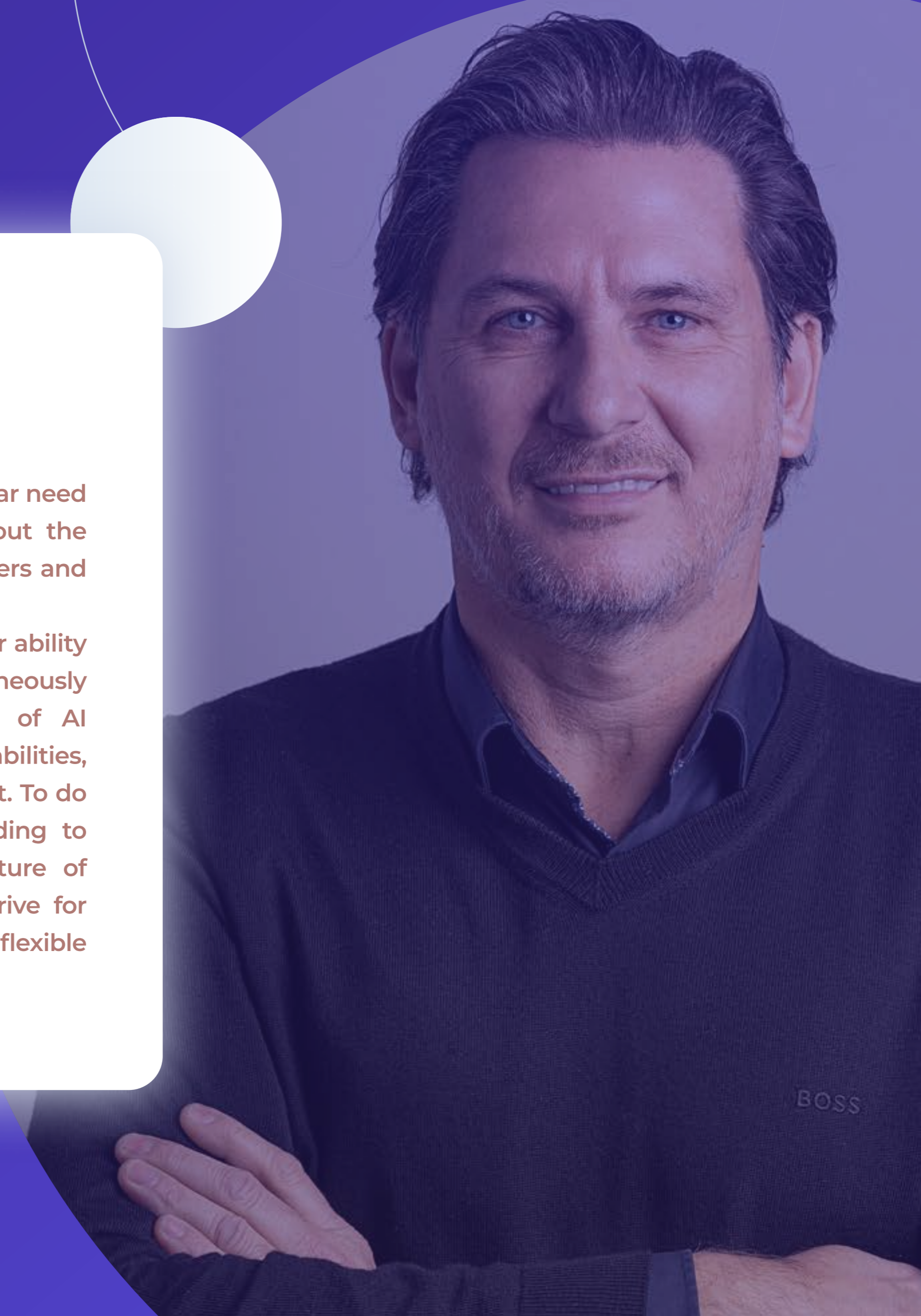


Expert commentary

Ronald Binkofski

With capacity being CTOs' next biggest concern, the data demonstrates a clear need for strategic planning so that businesses can be Agile enough to ride out the challenges of the coming years and successfully meet the needs of customers and employees.

As we look ahead to the coming year, success for CTOs will be defined by our ability to balance a commitment to consistent delivery while simultaneously accommodating growth, all while harnessing the immense potential of AI technologies. Economically and efficiently scaling an organization's tech capabilities, teams, culture, and processes, while leveraging AI innovations, is no easy feat. To do this, we must embrace technology that can easily be scaled up according to business needs, adopt modern engineering practices, and foster a culture of continuous learning and innovation at a minimum. For this CTOs will strive for partnerships that are supporting mid-term planning and related Agile and flexible execution capabilities.



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SURVEY RESULTS & INSIGHTS

The Global CTO Survey

Thank you!

HAYS

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