Techstrong Research

AI-augmented DevOps: Trends Shaping The Future

COMMISSIONED BY Tricentis

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Executive Summary

AI, AND PARTICULARLY GENERATIVE AI, dominates the current conversation about software development and testing. As our research shows, AI's time has arrived, and contributors across the software development lifecycle (SDLC) have quickly begun experiencing tangible gains in terms of productivity, software quality, and career advancement.

In the 2022 AI-Augmented DevOps study conducted by Techstrong Research and Tricentis, respondents were optimistic about AI's potential, with 90% indicating they were aware of the significant potential benefits of AI's use in DevOps and software development. Less than a year later, ChatGPT 3.0 and subsequent versions arrived on the scene, shortly followed by AI copilots, often embedded in developer IDEs, for code completion and code generation.

This year's research aims to understand to what extent those anticipated benefits have been realized and how a lack of trust, skills, or other challenges affect its adoption. The report also explores how and where teams are most commonly using AI, ML and generative AI, and perspectives on how this game-changing technology will transform how we approach building, testing, and delivering software.

Our research finds both the productivity gains and ability to address challenges with AI-augmented technology remarkable, given the relative newness of generative AI. This trend is likely to increase, given the heavy AI investments technology vendors are making and releasing into the market during 2024.

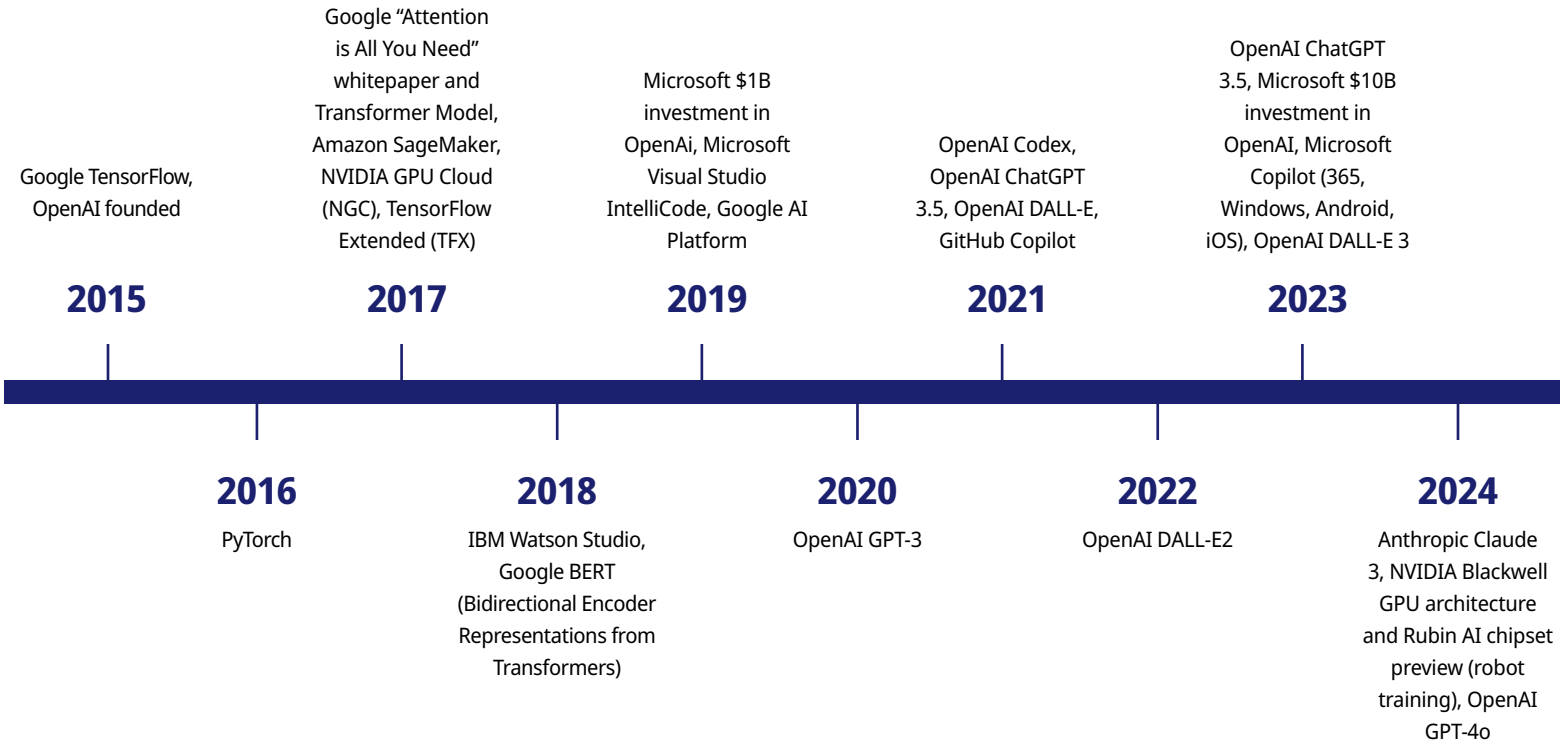
It's important to remember we are still in the early days of understanding how to create and train generative models (LLMs/SLMs) for software development, testing and security. Development copilots are trained on very large sets of open source and openly available code, but that doesn't mean generative AI can reliably or consistently generate high-quality, secure code, or that we can always trust its outputs. Still, we expect those capabilities, along with many more AI use cases across the SDLC, to advance at a rapid pace.

To take advantage of AI's potential, it will be critical to understand its most valuable use cases, the required skills, and the potential challenges teams will face as they incorporate these technologies into their workflows. This research aims to provide valuable insights to help you navigate the changes ahead.

Key Findings:

- Nearly a quarter (24%) of all 2024 respondents indicate they are currently using AI in one or more areas of the SDLC.
- There is broad application of AI across the SDLC, with about 20% of respondents indicating they already use AI in all phases of the SDLC.
- Development and testing are the most common use cases for AI technologies, with nearly half (44.7%) of teams adopting AI to augment development and over one-third (39.7%) using it in testing.
- AI's productivity gains are most significant in development and testing, with 60% reporting that developers are more productive due to AI (up from 43% anticipated in 2022) and 42% reporting productivity gains in testing and QA (up from 32% anticipated in 2022).
- Testing is cited as the most frequent use case for generative AI, followed by various coding tasks, ChatBots, and end-user documentation.
- Among mature DevOps teams, those who have implemented AI are significantly (30%) more likely to rate their team as extremely or very effective.
- Of the 13 common technical challenges our research assessed, between 20% and 45% of respondents report that AI is already helping address those challenges.
- Lack of AI skills is the most frequently cited challenge in the implementation of AI-augmented DevOps, followed by a lack of time to develop AI strategy and budgeting/cost concerns.
- 9% of respondents say they have complete trust in AI's output, while the overwhelming majority (86%) say that some or significant human verification is required.
- 62% of respondents believe that the introduction of increased regulation will help build confidence in AI usage.

Monumental AI Milestones for DevOps



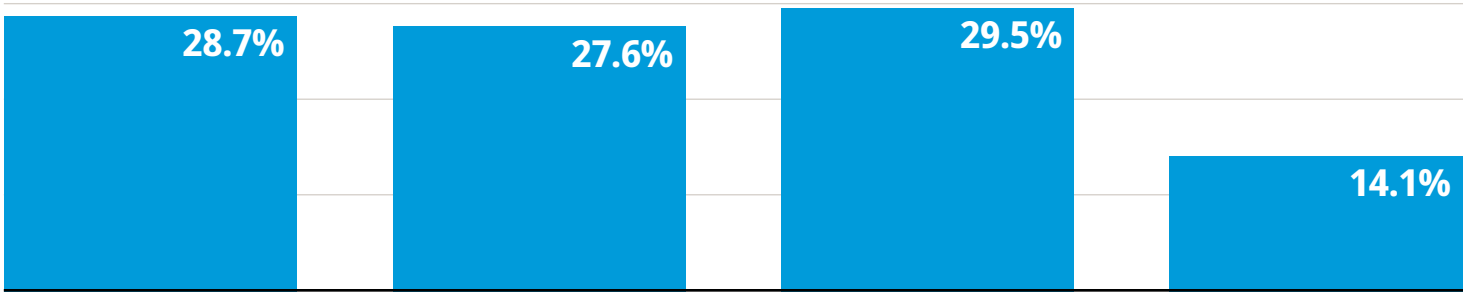
DevOps Maturity Paves the Way for AI

Techstrong Research and other research organizations show a vibrant and growing marketplace for DevOps. The global DevOps market size was valued at $6.78 billion in 2020, and is projected to reach $57.90 billion by 2030, registering a CAGR of 24.2% from 2021 to 2030. DevOps/DevSecOps is the most common software development methodology globally, used by 47% of software development teams in 2022 (compared to 35.9% in 2021).

Techstrong Research's 2024 data shows that nearly three-quarters (71.3% total) of organizations are using DevOps beyond the initial "getting started" phase (28.7%) and two-thirds (68.6%) indicate beginning their DevOps adoption from 2019 to 2024.

14.1% of respondents consider themselves high-functioning DevOps Unicorns, empowering their adoption of multi-cloud, flexible infrastructure and Infrastructure-as-Code (IaC). Others are operationalizing (27.6%) and standardizing (29.5%) DevOps through CI/CD, automated testing and integrated security testing as part of the SDLC.

Which of the following best describes your organization's current level of DevOps maturity (where each of the following stages builds on the last)?



Getting started: We are doing code reviews and have improved collaboration, dev/test experience and productivity

Operationalizing DevOps: We are practicing continuous integration and delivery (CI), with automated builds and automated testing

Standardizing DevOps: We are practicing CI/CD with security testing integrated into the development lifecycle

DevOps unicorn: We are cloud-native (multi-cloud, flexible infrastructure; infrastructure-as-code)

Generative AI Use is On the Rise in Dev and Test

The anticipated benefits of AI in DevOps are being realized in 2024. A quarter of respondents say they are actively using AI in DevOps in their organizations today.

Advancements in AI have led to its greatest use in software coding, testing, planning and build processes.

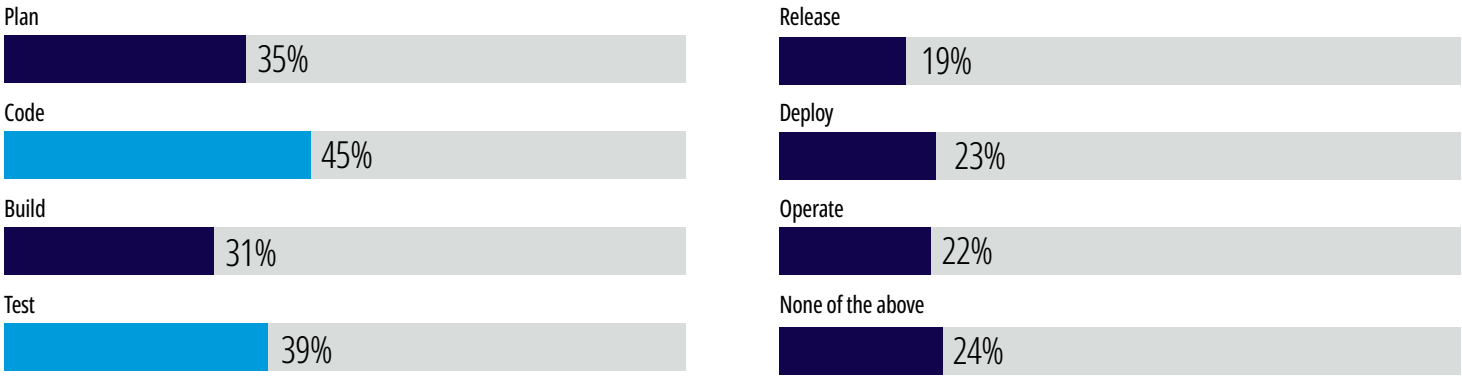
This is mostly due to generative AI appearing on the radar of all software developers with ChatGPT in late 2022 and the rapid and continued release of "copilots" for development and other functions.

Is your organization using AI-augmented DevOps tools today?

According to Goldman Sachs Economic Research, global investment in AI technologies will reach $200 billion by 2025, and software development, testing and DevOps will continue to see significant investment in AI.

Techstrong Research predicts software organizations reporting the use of AI-augmented DevOps tools will triple to 75% by 2025.

In which DevOps phases is your organization currently using AI?



AI In DevOps Addresses Significant Business and Technical Challenges

The greatest shifts in the benefits of AI in 2024 (as compared to our 2022 data) are in Developer Productivity (59.9% up from 43%) and the focus on Software Quality (42.1% up from 32%).

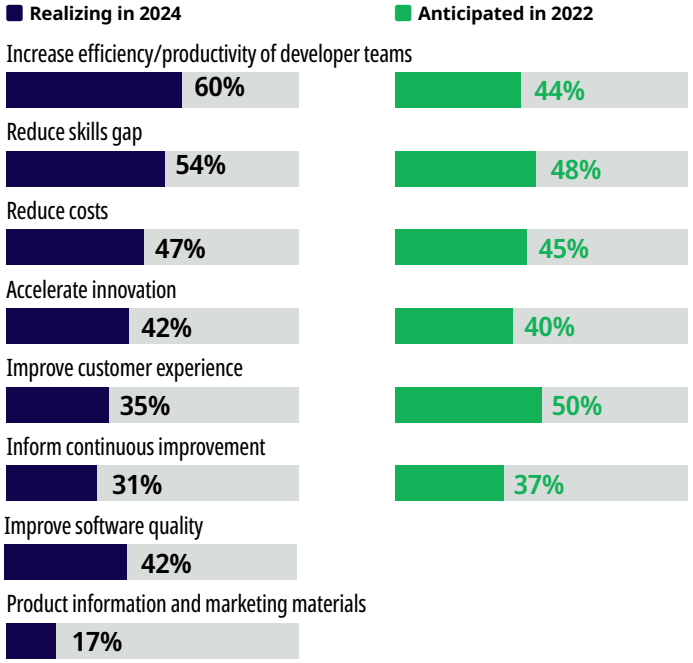
While past research clearly points us to CI/CD as the "heartbeat of DevOps," where most organizations and teams start their DevOps adoption, investments and the most tangible manifestations of AI in DevOps tools today are in increasing the productivity and efficiency of developers (59.95%) and the skills gaps in other roles (53.2%, quickly followed by reducing costs (47%) and improving software quality (42.1%).

2024 saw the rapid introduction of "copilots" in nearly every part of the SDLC, with the most notable in code completion, code creation and test automation.

Conversely, improving Customer Experience decreased the most (down to 34.8% from 48%), likely because organizations are heavily in the adoption and operationalizing phases of using AI in areas where the greatest productivity gains can be achieved, dev and test.

With the proliferation of AI copilots in nearly every tool for knowledge and technical workers, Techstrong Research expects that AI copilot functionality will be available for use in close to 100% of the roles across the SDLC by the end of 2025.

What business challenges is AI-augmented DevOps currently helping you address?



> *AI-augmented DevOps is going to be central to the entire scope of DevOps and DevSecOps.*
>
> **—Quote by Study Respondent**

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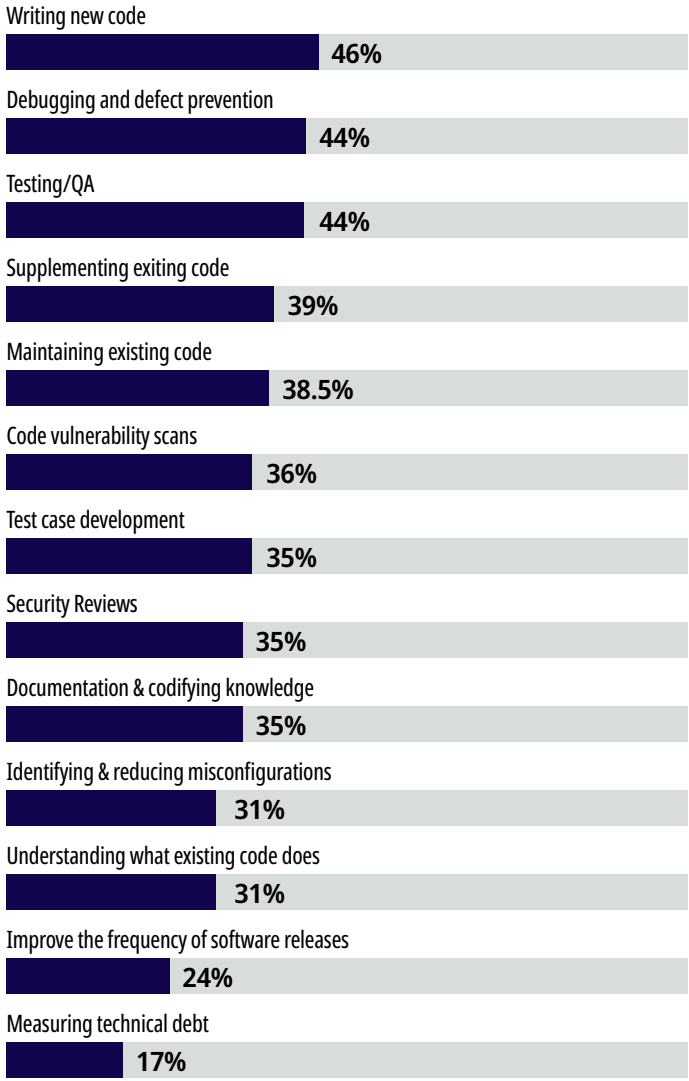
AI has Broad Applications Across the SDLC

AI-driven code creation, review and optimization are revolutionizing how code is developed, tested, and maintained, significantly reducing errors and improving code quality without human intervention. AI addresses a broad array of DevOps requirements, supplementing traditional coding and testing strategies.

Across the thirteen technical challenges areas in our research where AI in DevOps is currently helping address, between 20% and as much as 45% of respondents are already benefiting from AI. That is remarkable given the relative newness of generative AI but is also confirmed by the heavy investments in AI technology vendors are making and releasing into marketing during 2024. And, while these technical challenge areas focus primarily on dev and test, generative AI and natural language processing (NLP) interfaces are addressing challenges in nearly every aspect of the SDLC.

What technical challenges is AI-augmented DevOps currently helping address?



How Respondents are Using AI in DevOps Today

Testing
52%

ChatBot
47%

End -user or technical documentation
38%

Copilot to complete lines or small sections of code
37%

Copilot for writing complex sections of code
35%

Debugging
34%

Copilot for writing small applications
34%

Creating reports for security, governance or compliance
27%

None of the above
8%

How respondents are using AI in DevOps today (continued)

> *Software development has improved a lot with AI-generated code. It has become faster. Developers can now spend more time analyzing security and compliance needs.*

> *I want to use it to speed up test planning, writing, reporting, and execution.*

> *We use AI for learning/explanation. It will help developers to write faster code and it will explain complex code so juniors can understand it more in detail.*

> *Software documentation automation: combining data from source code and log files to generate various diagrams. AI is a remarkable time saver for generating scripts for that purpose.*

> *I'm using AI to try out different coding ideas. I find it helpful to transform code or configuration data from one format to another.*

Our research showed that writing code and testing are the two leading areas where participants are using AI copilots today.

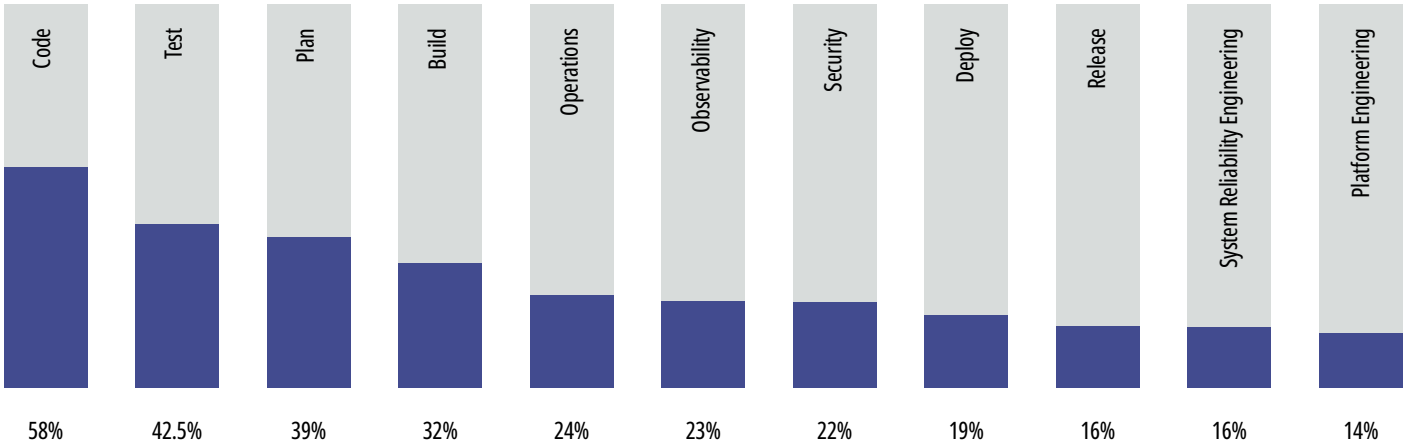
The growth of AI infused testing is a natural step for DevOps teams who need to keep pace with the rise of developer output due to the rise of AI-assisted coding.

In addition to writing, debugging and testing code, machine learning models can help in predicting potential workflow bottlenecks and degradations before they impact software delivery. Furthermore, AI-driven tools such as anomaly detection systems will seamlessly integrate into continuous integration and continuous deployment (CI/CD) pipelines, enhancing the speed and security of automated processes.

There is no sign of this heavy investment in AI in DevOps letting up anytime soon, whether in vendor technologies or by development and IT teams themselves.

Techstrong Research predicts AI's role in DevOps will extend far beyond dev, test and automation in 2025 and beyond, entering realms of predictive analytics, DevOps workflow analysis and improvements, security and more secure code creation, software quality, technical debt reduction and many areas of operational efficiency.

In which DevOps areas is your team using AI copilots today?



AI's Current Value Is Significant, But More Investment Is Needed

Software and DevOps teams are very optimistic about their experiences with AI in DevOps to date. Testing (59.6%), coding (57.7%), security (54.8%), observability (53.4%), software builds (52.9%), SRE (50.4%) and operations (50.1%) all receive high marks for value delivered by AI.

It's worth noting that AI's impact on security follows immediately after coding and testing. AI-driven tools can proactively identify and remediate vulnerabilities, enhance threat detection and automate responses to emerging security threats.

There remain opportunities where further investment in AI is needed in the phases of release, deployment, platform engineering, and planning. These areas, crucial for the stability and scalability of software systems, stand to gain immensely from advanced AI's capabilities by predictive failure analysis, resource optimization, and streamlining of maintenance, operations and management processes.

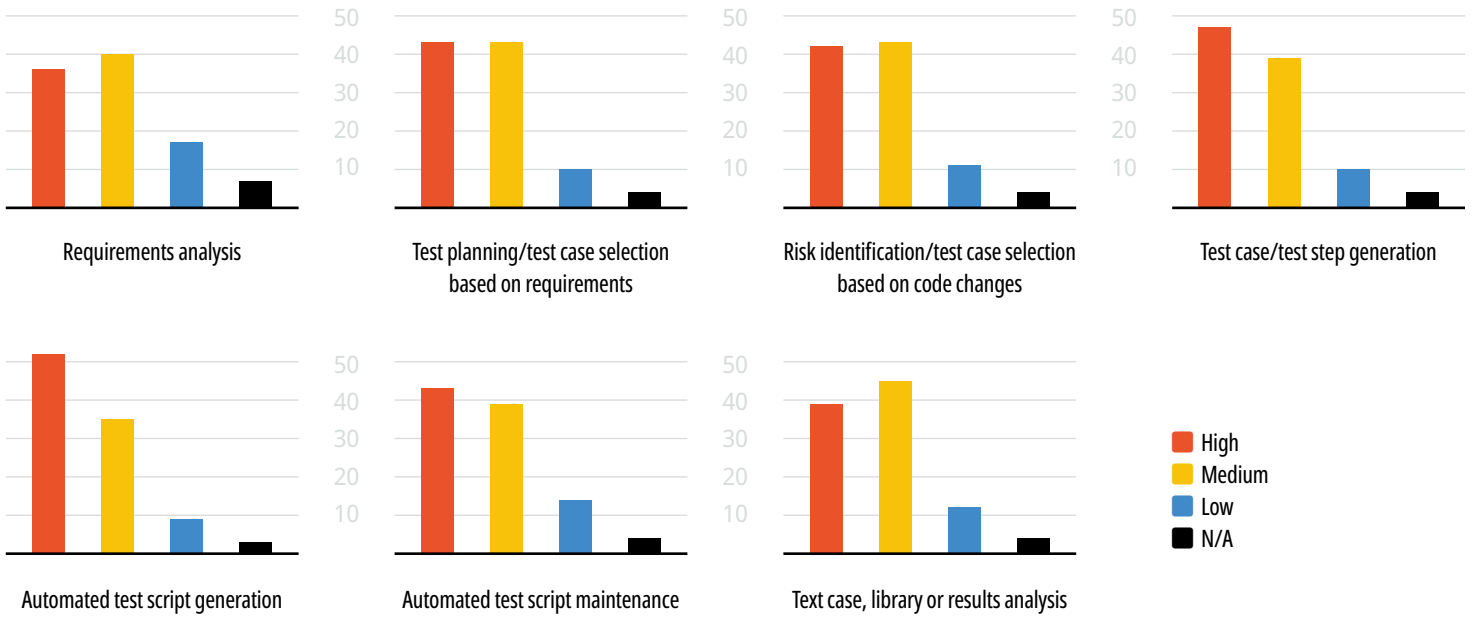
Rate the value of your current AI investments on the following DevOps areas

		Extremely Valuable	Very Valuable	Somewhat Valuable	Not So Valuable	No Value	Not Investing
Plan	**48.7%**	**20.67%**	**28.03%**	26.37%	5.40%	2.14%	17.34%
Code	**57.7%**	**21.62%**	**36.10%**	25.89%	3.56%	1.66%	11.16%
Build	**52.96%**	**17.81%**	**35.15%**	22.33%	5.70%	1.90%	17.10%
Test	**59.62%**	**23.52%**	**36.10%**	19.00%	5.70%	1.43%	14.25%
Release	**44.42%**	**17.10%**	**27.32%**	23.28%	8.08%	3.56%	20.67%
Deploy	**44.18%**	**17.81%**	**26.37%**	22.57%	8.55%	3.80%	20.90%
Operations	**50.12%**	**20.90%**	**29.22%**	23.28%	4.99%	3.09%	18.53%
Security	**54.85%**	**25.89%**	**28.98%**	21.14%	4.51%	2.85%	16.63%
Observability	**53.44%**	**20.19%**	**33.25%**	21.38%	5.46%	2.38%	17.34%
Platform Engineering	**46.32%**	**18.53%**	**27.79%**	23.99%	7.36%	2.85%	19.48%
System Reliability Engineering	**50.36%**	**20.43%**	**29.93%**	21.38%	6.41%	2.38%	19.48%

AI Promises Significant Strides for Software Quality

Respondents to our research spoke loud and clear, identifying where AI brings valuable benefits to software testing. Based on our survey, 42% of respondents highlighted the benefit of requirements coverage through test case selection, while 52% emphasized the importance of script generation. Additionally, 42% of respondents expect AI to perform a risk analysis of code changes, helping QA teams focus on code areas with the greatest risk of errors due to code changes.

For which testing tasks do you think AI/ML/GenAI is or will be most helpful?



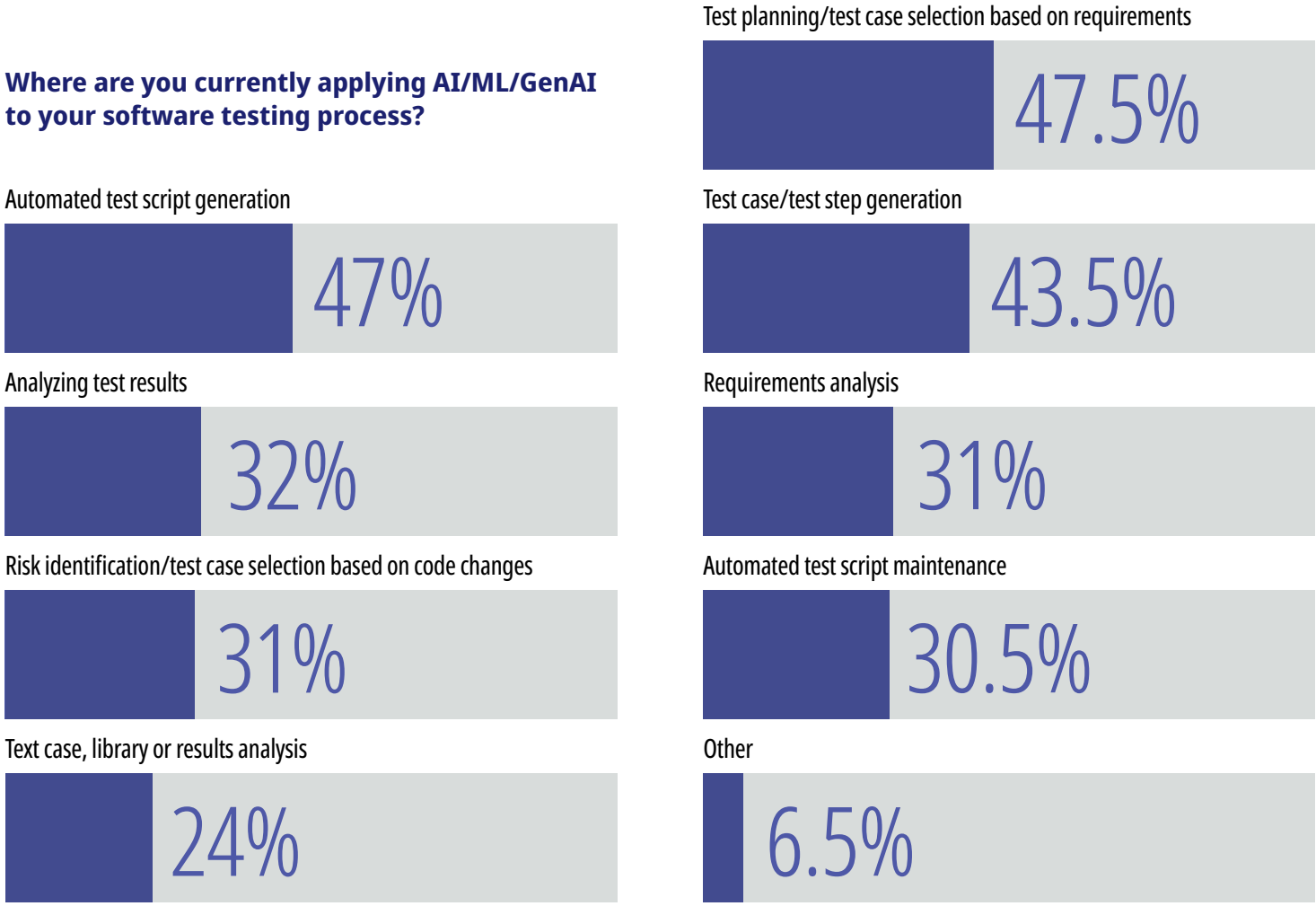
Our data indicates that after coding, testing is the most in-demand area for AI tool adoption. The rapid rise in AI-generated code is shifting the balance of labor from writing code to everything else that follows — and in particular, testing. To maintain the coding productivity gains offered by gen AI, we expect to see an ongoing uptick in the adoption of AI-augmented testing tools. This application of AI not only accelerates testing cycles but also enhances the accuracy and reliability of AI-generated code. To understand more about how teams augment testing with AI, we asked respondents where in the testing process they are currently applying AI technologies.

The results show that teams use AI to augment a wide range of testing tasks. In test planning, AI algorithms analyze historical data and/or requirements to predict the most critical areas to focus on and identify existing test cases and gaps in coverage, thereby optimizing the testing efforts needed. For test case generation, AI tools can automatically create diverse test scenarios and data sets that mimic a range of user behaviors and software environments, expanding the coverage and depth of tests in a shorter period of time.

Automated script generation, another critical AI use case, allows for the rapid creation of test scripts based on changes in the codebase, thus maintaining the relevance and timeliness of test suites. By updating test scripts as applications change, AI-augmented maintenance can eliminate a traditionally time-consuming task and minimize flakiness. AI can also help teams summarize and analyze test results to identify patterns and anomalies and prioritize issues based on their potential impact (see graph on next page).

Process, Automation and Data = Measurable, Repeatable Outcomes

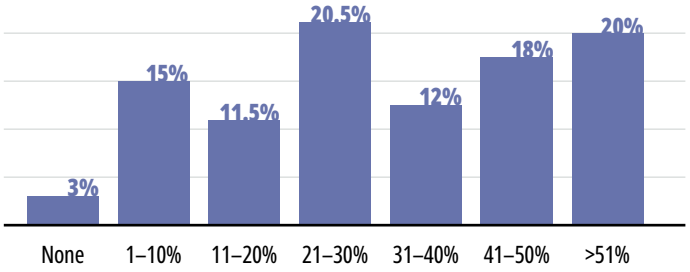
Where are you currently applying AI/ML/GenAI to your software testing process?



AI Promises Significant Strides for Software Quality (continued)

Moreover, with a solid automation infrastructure in place, AI can be seamlessly integrated to enhance these processes, such as by generating more complex test cases or the dynamic adjustment of test scripts in response to code changes. Thus, teams with mature test automation practices are more likely to be able to leverage AI effectively, leading to more sophisticated, adaptive, and efficient testing processes that can keep pace with rapid development cycles and increasing software complexity.

Approximately what percentage of your total testing efforts are automated?



AI significantly enhances the efficiency and effectiveness of QA through several key applications. In test planning, AI algorithms analyze historical data to predict the most critical areas to focus on, thereby optimizing the testing efforts needed. For test case generation, AI tools can automatically create diverse test scenarios and data sets that mimic a range of user behaviors and software environments, significantly expanding the coverage and depth of tests beyond what manual efforts could achieve.

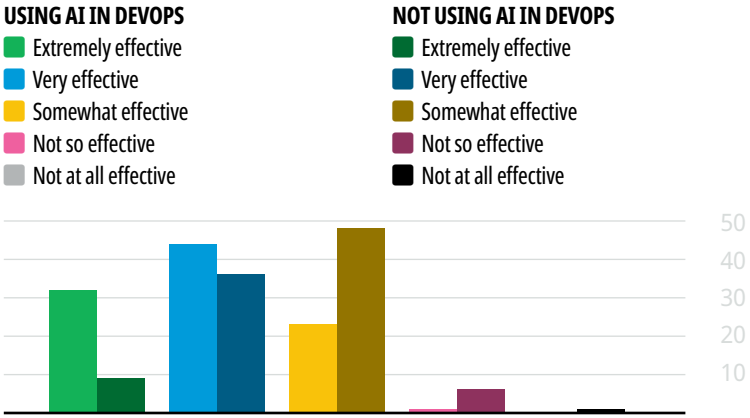
While test automation is critical, it alone may not be enough to match the increasing pace of AI-driven development.

Some of these dilemmas can be addressed as AI is able to autonomously fix or repair basic bugs in software, which will gain more sophistication over time. AI's greatest potential is in its increasingly sophisticated ability to analyze of the causes of errors, whether human or AI created, and identify steps to take that will eliminate the error from occurring at its source.

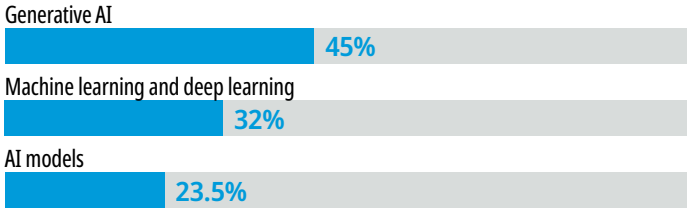
AI's Impact on People, Processes, and Productivity

While the adoption and maturity of DevOps practices are high, there still is a notable disparity in how effectively these practices align with rapid business demands. Our research data reveals that over 60% of respondents indicate that DevOps practices "Always" or "Usually" keep pace with business needs, underscoring their crucial role in fostering agility and responsiveness. However, this positive statistic leaves a concerning 40% where DevOps practices have yet to fully realize their potential, suggesting areas within the integration, automation, and application of DevOps that require further refinement and investment to ensure they fully support and drive business objectives. Can AI make a meaningful difference in filling in this gap? Respondents see many opportunities for AI within DevOps and with our business uses of AI.

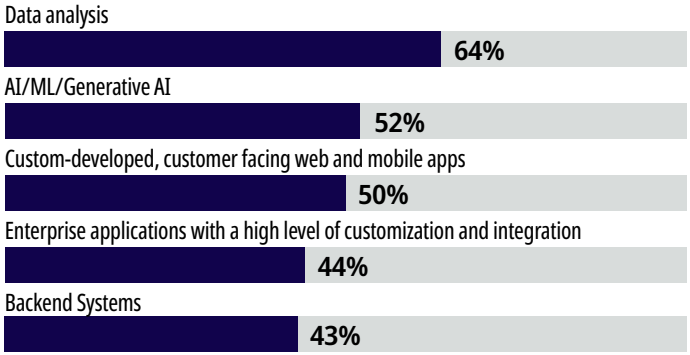
How would you rate the overall performance of your organization's DevOps team?



What types of AI do you currently use within the software applications you build and support?



For which types of applications do you think AI-augmented DevOps is particularly well suited?



> *The application of AI throughout the SDLC will also aid, if not be a significant driver, in the adoption and successful outcomes of DevOps. Many advances and surprises are expected as we truly are only at the beginning of this AI in DevOps journey.*
>
> **—Mitch Ashley, Futurum Group and Techstrong Research**

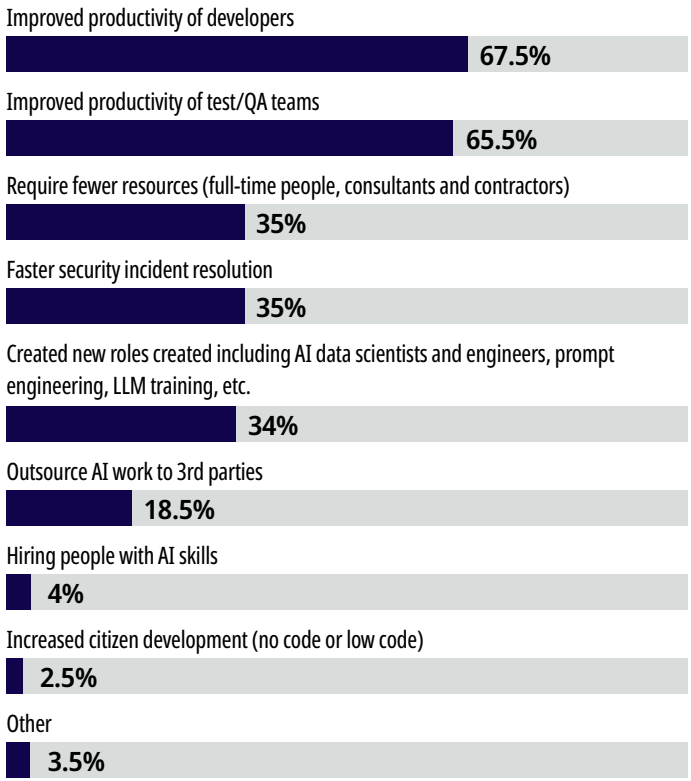
AI's Impact on People, Processes, and Productivity

(continued)

It didn't take long after the general population learned about the power of generative AI in 2022 before visionaries, pundits, entrepreneurs and analysts began making claims that soon we would not need human developers. This echos claims in the early DevOps days a decade ago, which said the world would no longer need testing or operational personnel – developers would eliminate those jobs. In the years since, we can all see those roles did not disappear with the introduction of DevOps, but may have actually made other roles more critical.

Yes, AI in DevOps and testing should enhance our productivity and creativity at work, but it won't replace roles because software systems are inherently complex, requiring human expertise to integrate various code components. Natural language descriptions to GPTs are often lossy and insufficiently precise, making it challenging to convey exact software requirements in plain English. Therefore, it remains easier and more effective for humans to code and test software directly.

How is AI changing job functions?



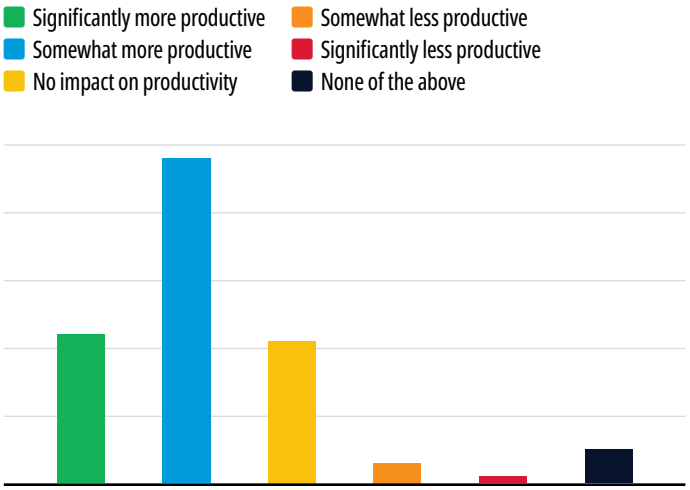
AI's Impact on People, Processes, and Productivity

(continued)

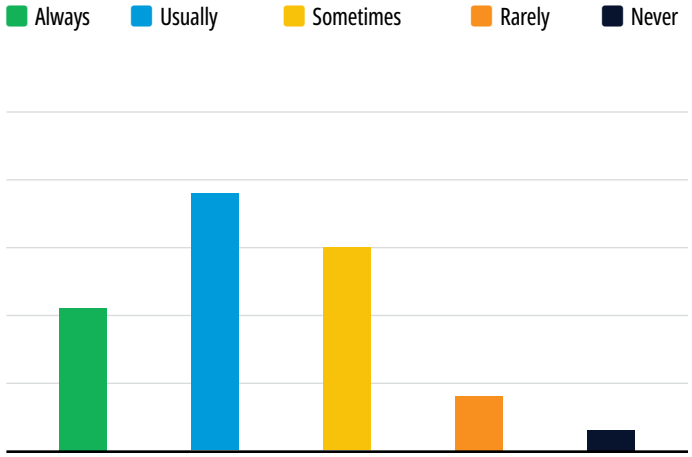
In the meantime, how has AI in DevOps impacted people's roles and productivity? How effective are we at leveraging AI in DevOps?

Techstrong Research's study shows that about an equal number of people report they are significantly more productive (21.5%) as the number who reported no change in productivity (20.7%). As we've seen previously in this report, developers (67.5%) and software testing/QA teams (66.5%) are receiving the early productivity windfalls from AI in DevOps. The significant middle (48.1%) who have seen modest productivity improvements may be later adopters of AI as other DevOps tools and platforms begin releasing copilots and other AI features.

How much is AI impacting your DevOps team's productivity?



Can your DevOps organization keep up with the customer and stakeholder demands for new features and enhancements?



AI's Impact on People, Processes, and Productivity

(continued)

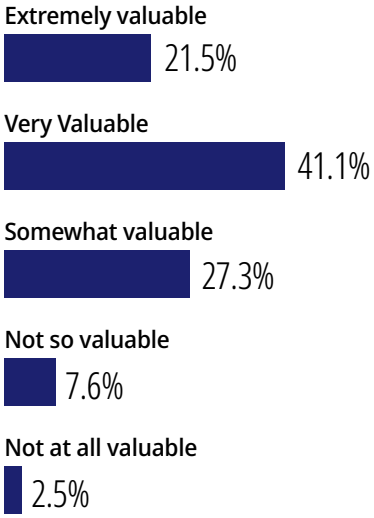
We also see AI in DevOps clearly creating new roles, with 34% hiring data scientists, and increasing the demand for new skills, with 33.7% hiring new AI skilled resources. The productivity gains, particularly in dev and test, are likely responsible for respondents see a need for fewer resources (35%) which can manifest as greater capacity, slower hiring, layoffs or reassignment of jobs.

Productivity gains aside for the moment, do respondents specifically attribute AI as a source to increasing their ability to achieve goals for DevOps goals? A resoundingly large majority say 'yes' with 89% reporting somewhat (27.3%), very (41.1%) and extremely (21.5%) valuable. These results are hard to ignore.

Code Generation and Language Server Protocols have automated the coding process, and in combination with GitHub Actions, the continuous refinement of the released product through git commits is now painless.

—Quote by Study Respondent

Rate the current value of AI-augmented DevOps in terms of improving teams' ability to achieve DevOps goals.



We can generate baseline code faster, pivot to embrace new languages/tech, our test automation is far better.

—Quote by Study Respondent

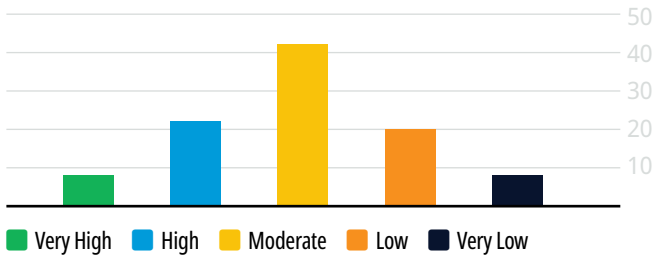
AI's Impact on People, Processes, and Productivity

(continued)

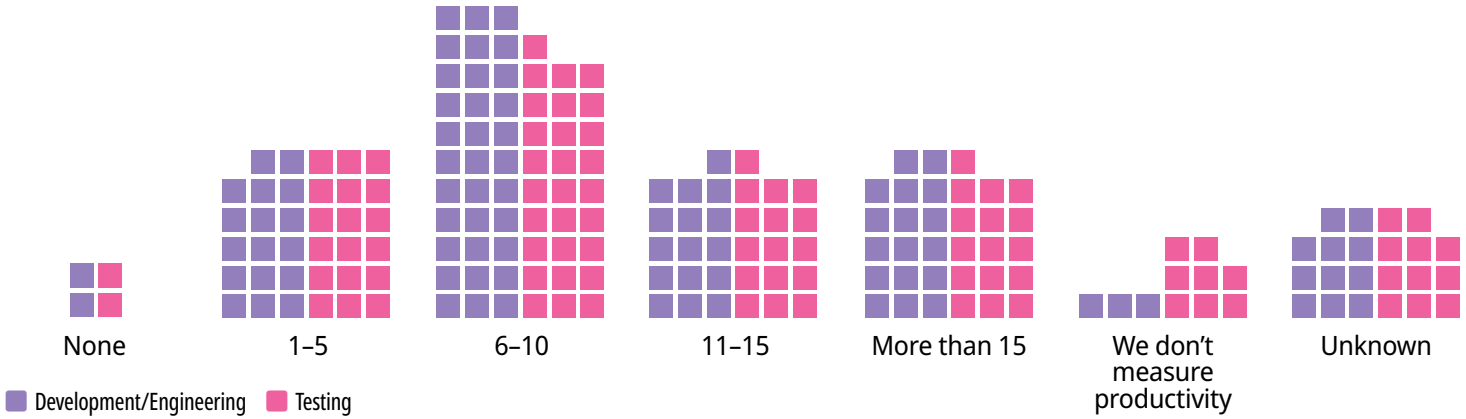
Another indicator that we are yet early in this AI journey is our current skill level or ability to leverage AI in DevOps. An impressive 42.4% report moderate skills already while only 22.4% and 7.7% report high or very high skill levels, respectively, in 2024.

Because we see such a favorable impact of AI in DevOps, is reasonable to expect adoption and skill level improvements will continue at a steady pace through 2024, leading into 2025-2026. The advancements to date indicate significant upside in virtually all areas of the SDLC because of AI.

How do you rate your team's current skill level in the use of AI technologies for DevOps?



How many hours per week do you estimate AI-augmented DevOps tools will save your team?

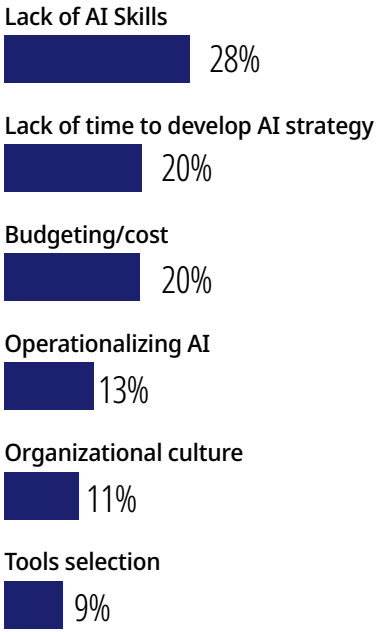


Potential Challenges in the Adoption of AI in DevOps

Despite the significant inroads AI has made in DevOps and across the SDLC, several key hurdles may hinder organizations from realizing its full benefits. A primary obstacle is the lack of AI-specific skills within teams. AI deployment and maintenance require specialized knowledge that is currently scarce in many IT departments, necessitating significant training or hiring efforts. Additionally, crafting an effective AI strategy, whether internally or through vendor collaborations, demands time, new knowledge and thoughtful planning to align AI capabilities with business goals. This strategic planning is often complex and can delay the adoption process.

The costs associated with implementing sophisticated AI solutions can be challenging, especially for smaller organizations or those with constrained budgets. These financial considerations extend beyond initial outlays to include ongoing expenses related to upgrading, scaling, and fine-tuning AI systems.

What is your biggest challenge to implementing AI-augmented DevOps?

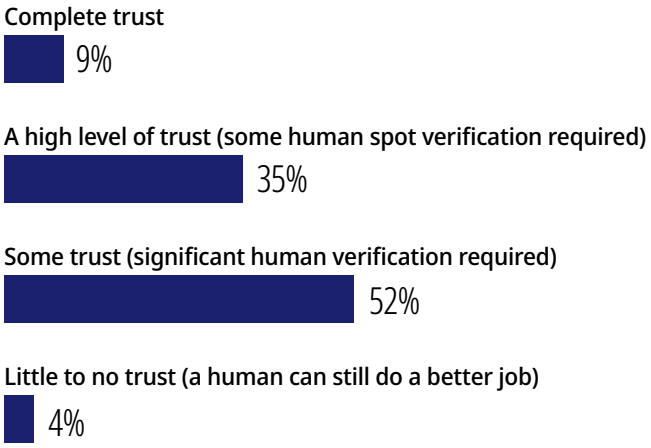


Measuring our Trust in AI

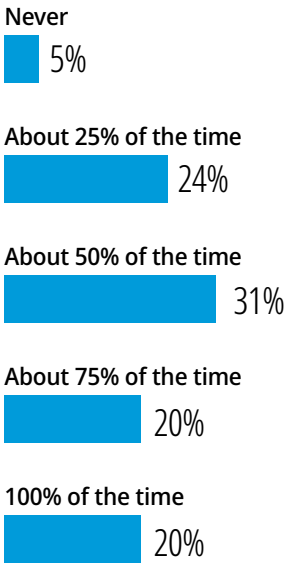
We are in an evolutionary period in our understanding of how much trust we put in the results created by AI. The data clearly shows that even though there is some trust in AI outputs, humans are still very much "in the loop," inspecting, improving or in some cases even discarding AI's results.

Only 9% of respondents say they have complete trust in AI's output, while the overwhelming majority (86%) say that some or significant human verification is required. Only 5% say that they place little to no trust in AI.

How much trust do you have in the outputs of your AI-augmented DevOps tool(s)?



How often do you review and/or modify AI outputs before you use them?

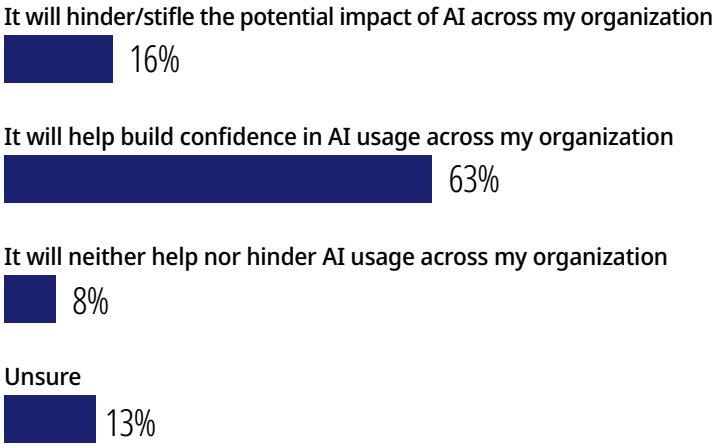


Measuring our Trust in AI (continued)

Other factors that may impact AI are the increased activities on the national and international regulatory front. While some experts, political bodies and pundits foretell a dark future where we lose control of AI, resulting in dire consequences to humanity, they and others are calling for early regulation and for there to be controls or limits put on AI.

Respondents to our research largely (62.5%) feel strongly that regulation will build confidence in AI's usage, while another a smaller but not insignificant number (15.9%) feel increased regulation will hinder or stifle the impact of AI in our organizations.

How do you perceive the introduction of increased regulation in the use of AI utilized in software tools and applications?

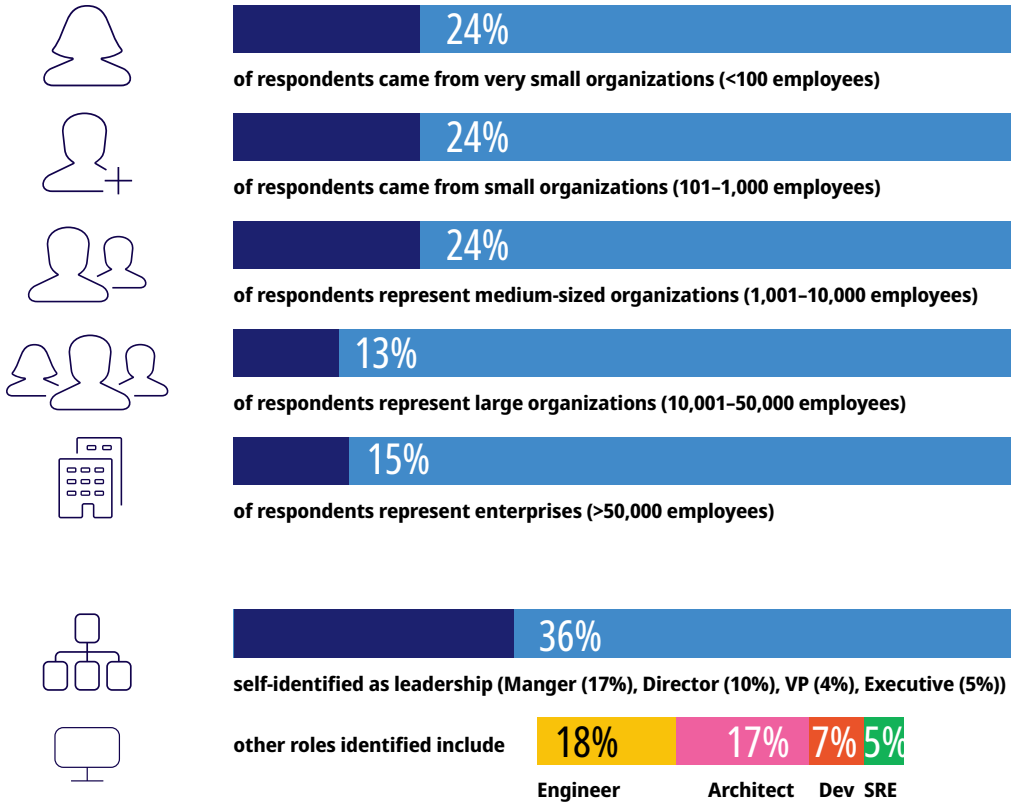


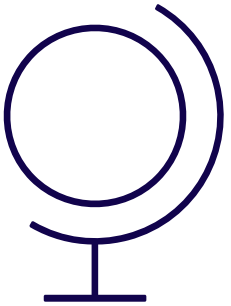
> *I think the US should lead [on AI regulation], but to be effective, we do need something global... Given what it takes to make these models, the chip supply chain, the sort of limited number of competitive GPUs, the power the US has over these companies, I think there are paths to the US setting some international standards that other countries would need to collaborate with and be part of, that are actually workable, even though it sounds on its face like an impractical idea. And I think it would be great for the world.*
>
> **~ Sam Altman, CEO of OpenAI at the May 17, 2023 U.S. Senate hearing on AI**

Survey Demographics

TechStrong Research conducted a global IT study, surveying AI use in DevOps. The survey was conducted during May and June of 2024. A total of 504 respondents participated in the research.

Respondents hold a variety of roles and come from a broad range of organizational sizes:





Survey responses came from a global cross-section of 62 countries in four major regions: **North America (47%), Europe (12%), APAC (22%)** and **LATAM (5%).**

Twenty industries were surveyed, including:

Telecommunications, Technology, Internet and Electronics
37%

Finance and Financial Services
13%

Education
7%

Healthcare and Pharmceuticals
5%

About the author

MITCHELL ASHLEY is a technology executive and entrepreneur who is an advisor, analyst, product creator and tech leader, bringing 30+ years in cybersecurity, cloud, AI, product development, software engineering and networking. Mitch is Chief Technology Advisor with The Futurum Group and CTO of Techstrong Group's platforms covering digital leadership, DevOps, cybersecurity, AI, cloud native, cloud infrastructure, platforms and ITSM. As a CTO, CIO, and VP of Engineering, Mitch led the creation of award-winning cybersecurity products utilized in the private and public sectors, including the U.S. Department of Defense.As CEO and President, Mitch also led business and technology for managed PKI services (broadband, Wi-Fi, IoT, energy mgmt. and 5G industries), product certification test labs and a SaaS business (93m transactions annually) and the engineering of the first video-on-demand, Internet cable services, national broadband network deployment and multiple telecom apps.

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About Techstrong Research

Techstrong Research accelerates the adoption of disruptive technologies that drive business outcomes and provide actionable strategies in rapidly changing markets. We are the only organization serving the needs of IT leaders, practitioners and the industry ecosystem with research, analysis, content, events and education. We bring deep knowledge about today's leading technologies such as DevOps, cloud, data and AI/ML, security/governance initiatives and supporting infrastructure. We offer our customers a holistic business perspective essential to adapt and thrive in the digital economy. The Techstrong Research team has the knowledge, experience and credibility earned by working with hundreds of businesses across many industries to provide consulting, thought leadership and research services.

Techstrong Research is relentlessly focused on the business outcomes of disruptive technologies.

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