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AI in software development:

Exploring opportunities and uncertainties

As software executives race to adopt artificial intelligence, productivity and value creation are reaching new heights.

Are you ready to join the AI revolution?

Foreword from OutSystems:

It's an exciting time to be an IT leader as all companies, led by innovators like you, race to implement artificial intelligence into various aspects of their business.

We built OutSystems over 22 years ago with one main goal: to simplify software development. AI is the next phase in this simplification, and we're excited about how it can help us drive that goal further. From generating code to automatically testing and improving it, we see massive potential for AI to augment human coding expertise and ultimately deliver better software products.

However, the pervasiveness of AI is not without risk. From scalability concerns to compliance issues, businesses are forced to closely supervise and iterate on the use of AI within their software delivery lifecycle.

This report will explore how AI is affecting the software development space, giving you practical insights for navigating both the exciting opportunities and risks that come with it. We believe that with the right information, innovators like you can leverage AI to its fullest potential.

Foreword from KPMG:

Artificial intelligence (AI) can revolutionize IT when adopted with a critical eye but innovative confidence.

Executives have already integrated AI into their software development life cycles (SDLCs), reflecting AI's versatility across domains, namely testing and quality assurance, security-vulnerability detection, application maintenance, user-experience design, coding assistance, and more.

Generative AI (GenAI), in particular, is driving the next paradigm shift in software development. It's not only automating repetitive tasks but also enhancing the creative process. Companies currently use or plan to use GenAI for software testing, with significant potential extending to DevOps optimization, code generation, documentation, and user-interface design.

But proceed with caution.

The rapid evolution of AI and GenAI presents challenges, from code hallucinations to data-privacy breaches, regulatory-compliance failures, and more.

This report will explore the transformative effect of AI on software development. Our aim is to equip IT executives and software decision-makers with insights for navigating this rapidly evolving landscape and leveraging AI as the competitive advantage it can be.

Executive summary

Software development has seen a massive surge in the adoption of AI over the last five years, and **93% of executives said they planned to increase their investment in AI-powered**[1] tools over the next two. Clearly, AI is a force to be reckoned with, and it's setting new standards for the industry.

As AI, particularly GenAI, continues to shake up the world of software development, organizations can't afford complacency. But neither can they let the fear of missing out be the primary catalyst for adoption. Significant risks remain, and they'll only continue to evolve. To realize the opportunities that come with integrating AI into the entire software development life cycle (SDLC), executives must combine strategic vision and agile execution.

So how are organizations rising to these imperatives? To gain a clear understanding of the transformative role of AI in software development, OutSystems and KPMG partnered with CIO Dive's StudioID to survey 555 software executives on current AI use, how they plan to use it in the future and the challenges they face.

What they learned provides insights and recommendations for how to incorporate AI in software development that identify and address the risks head-on and reveal new opportunities for innovation. The key findings from this report will enhance decision-making for driving your AI projects, today and in the future.

AI adoption soars, yet broader implementation remains elusive

The adoption of AI has ushered in a new era in the evolution of software development. Not since the rise of mobile and cloud apps in the early 2000s has the industry seen such disruption. After years of a relatively negligible increase in general adoption,[1] AI took off in the last year.
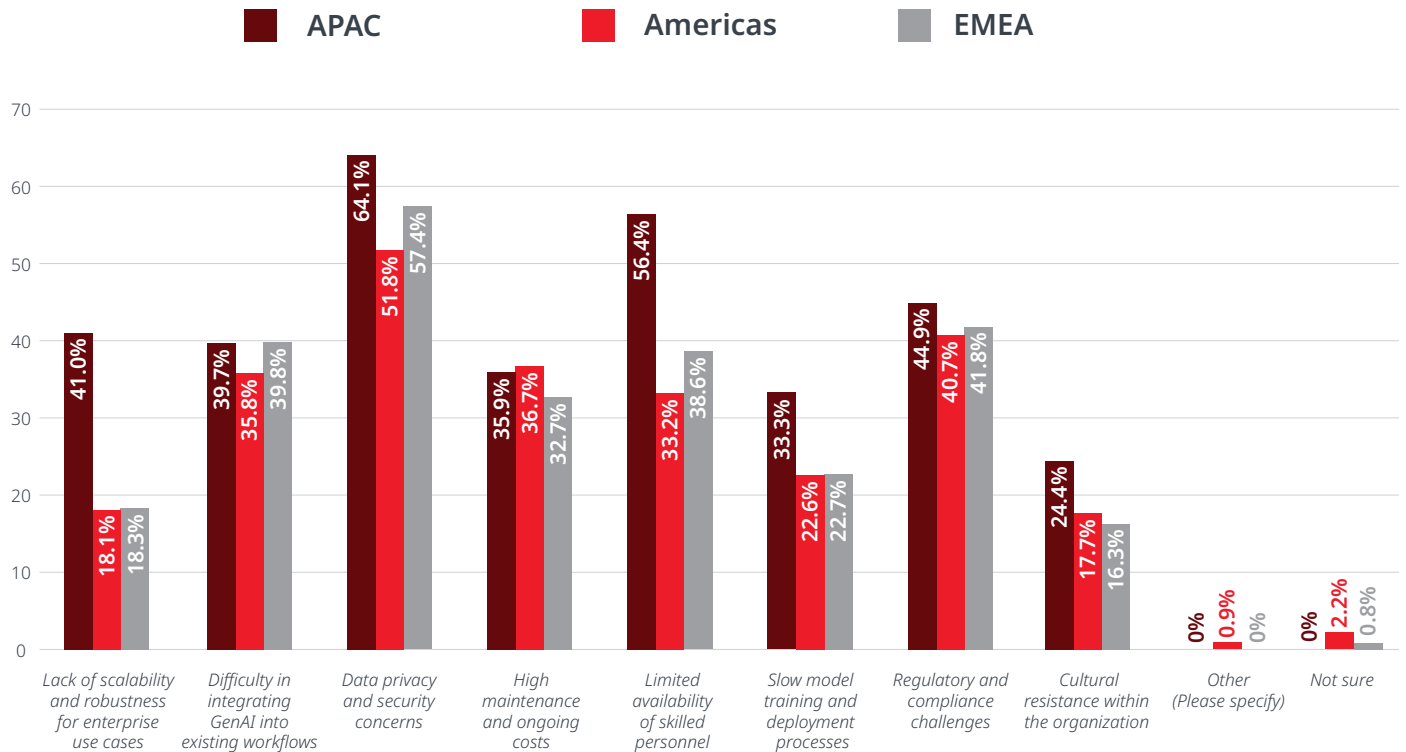
Sixty-three percent of respondents said they incorporated AI into their SDLCs between one and five years ago, with 66% doing so within the last six months to two years.

In terms of regional impact, North America slightly trailed Europe, the Middle East and Africa in adoption rates over the last six months to five years, with 83% compared with 87%.
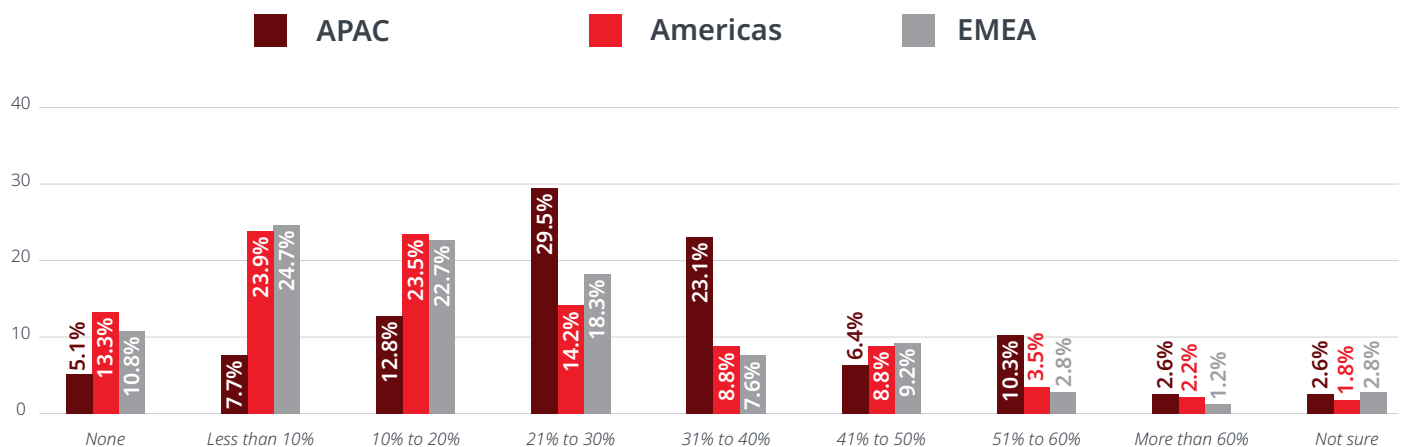
Companies in the Asia-Pacific region (APAC) are leading GenAI in code generation and refactoring and user-interface design. Twenty-one percent of APAC companies said they also expected GenAI to assist in more than 60% in code in five years, compared with only 15% in North America.
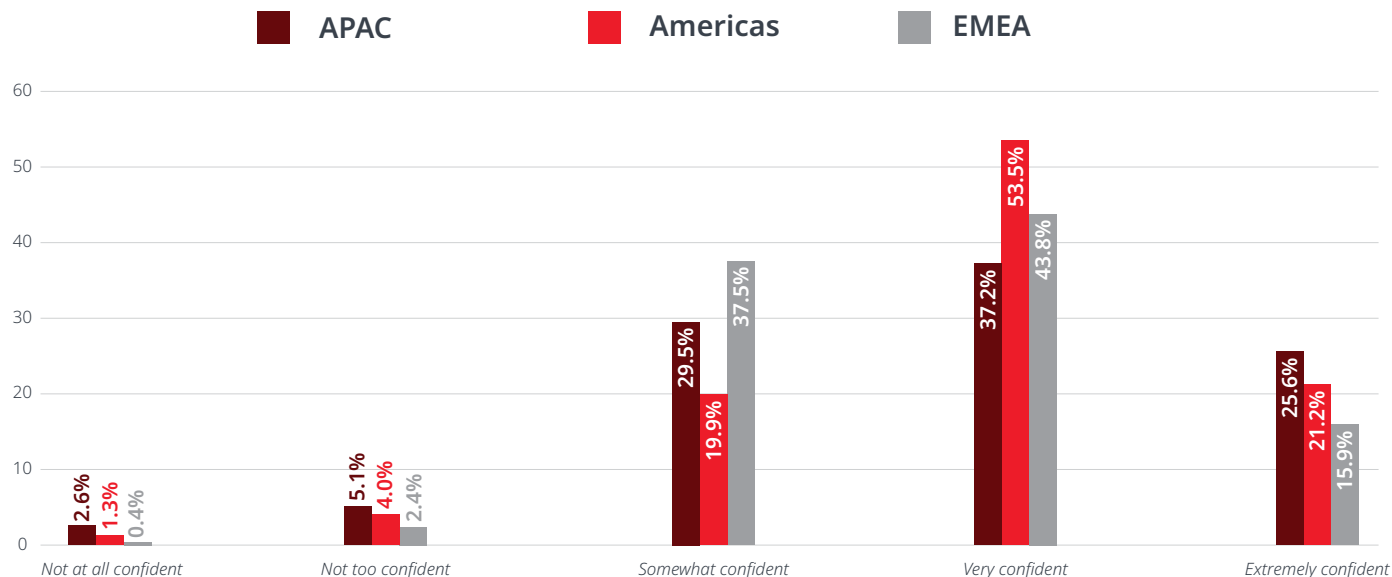
What are the primary barriers your organization is facing in adopting GenAI for application development and SDLC management? (Please select all that apply) - Selected Choice

Legend: APAC, Americas, EMEA

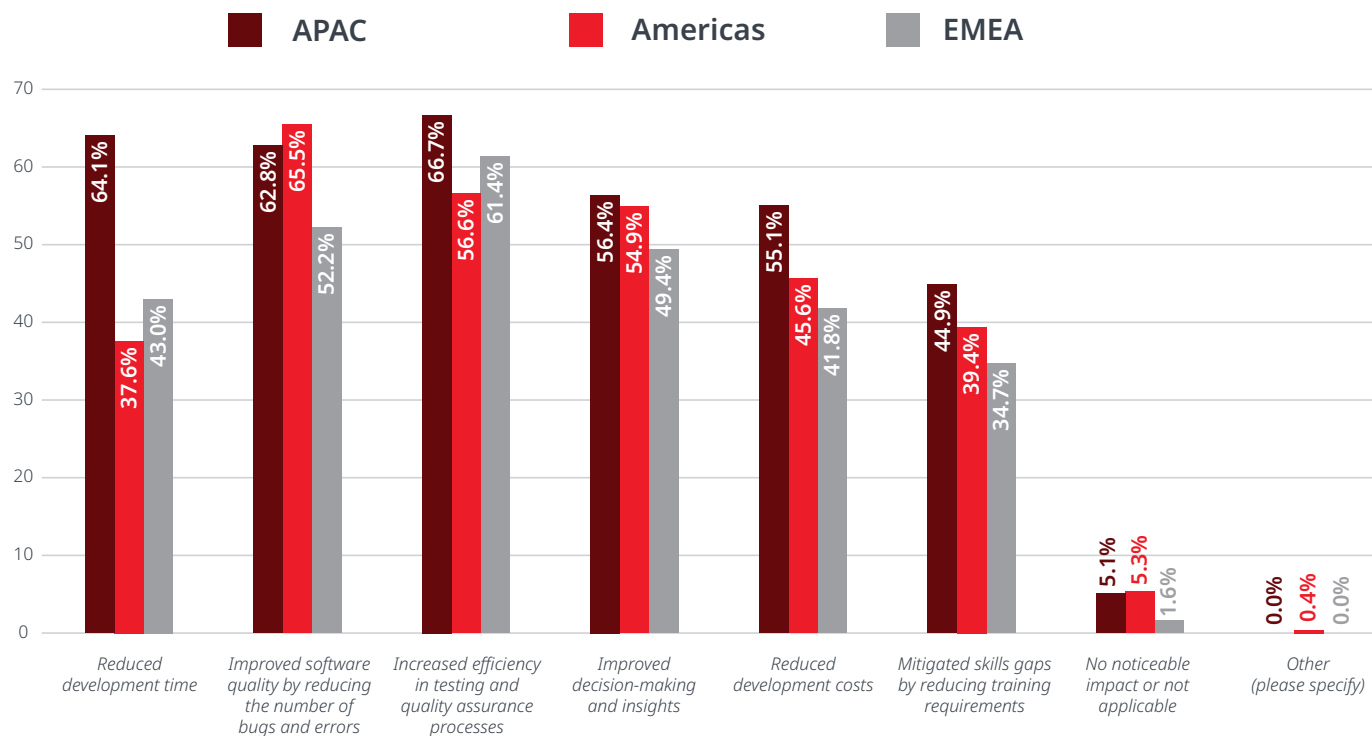| Barrier	APAC	Americas	EMEA
Lack of scalability and robustness for enterprise use cases	41.0%	18.1%	18.3%
Difficulty in integrating GenAI into existing workflows	39.7%	35.8%	39.8%
Data privacy and security concerns	64.1%	51.8%	57.4%
High maintenance and ongoing costs	35.9%	36.7%	32.7%
Limited availability of skilled personnel	56.4%	33.2%	38.6%
Slow model training and deployment processes	33.3%	22.6%	22.7%
Regulatory and compliance challenges	44.9%	40.7%	41.8%
Cultural resistance within the organization	24.4%	17.7%	16.3%
Other (Please specify)	0%	0.9%	0%
Not sure	0%	2.2%	0.8%

What percentage of jobs within your organization do you think will be eliminated based on the introduction of GenA/ML/AI tools for application development and SDLC?

Legend: APAC, Americas, EMEA

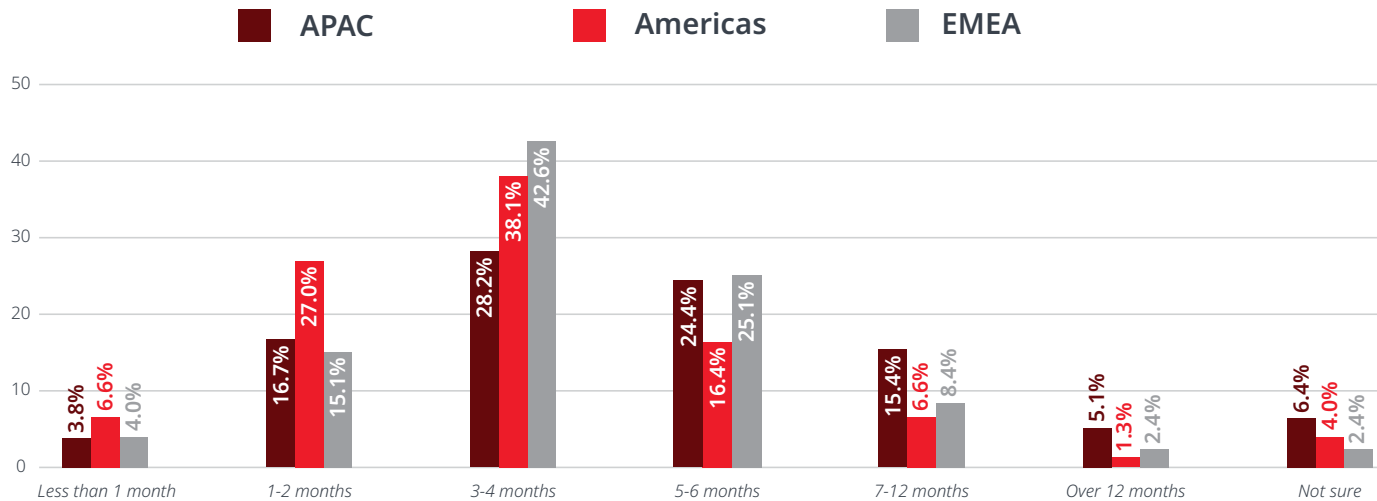|	APAC	Americas	EMEA
None	5.1%	13.3%	10.8%
Less than 10%	7.7%	23.9%	24.7%
10% to 20%	12.8%	23.5%	22.7%
21% to 30%	29.5%	14.2%	18.3%
31% to 40%	23.1%	8.8%	7.6%
41% to 50%	6.4%	8.8%	9.2%
51% to 60%	10.3%	3.5%	2.8%
More than 60%	2.6%	2.2%	1.2%
Not sure	2.6%	1.8%	2.8%

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How confident are you in the quality of code that has been artificially generated by AI, either full code generation or auto-completion? (Please select one answer)

Legend: APAC, Americas, EMEA

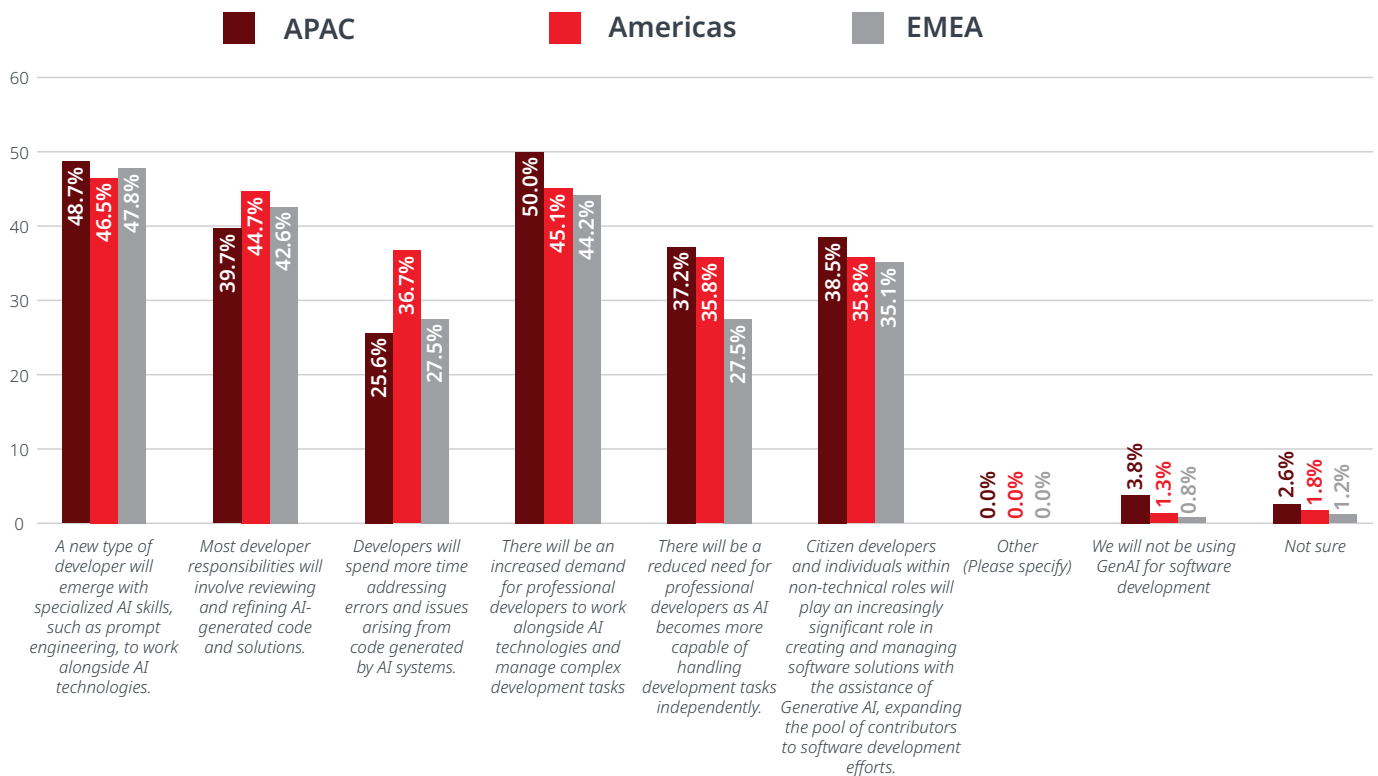|	Not at all confident	Not too confident	Somewhat confident	Very confident	Extremely confident
APAC	2.6%	5.1%	29.5%	37.2%	25.6%
Americas	1.3%	4.0%	19.9%	53.5%	21.2%
EMEA	0.4%	2.4%	37.5%	43.8%	15.9%

How has the implementation of AI technologies impacted your organization's application development and SDLC management processes? (Please select all that apply) - Selected Choice

Legend: APAC, Americas, EMEA

	Reduced development time	Improved software quality by reducing the number of bugs and errors	Increased efficiency in testing and quality assurance processes	Improved decision-making and insights	Reduced development costs	Mitigated skills gaps by reducing training requirements	No noticeable impact or not applicable	Other (please specify)
APAC	64.1%	62.8%	66.7%	56.4%	55.1%	44.9%	5.1%	0.0%
Americas	37.6%	65.5%	56.6%	54.9%	45.6%	39.4%	5.3%	0.4%
EMEA	43.0%	52.2%	61.4%	49.4%	41.8%	34.7%	1.6%	0.0%

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How long does it take, on average, for your organization to build an application that includes GenAI capabilities? (Please select one answer)

Legend: APAC (dark red), Americas (red), EMEA (gray)

	APAC	Americas	EMEA
Less than 1 month	3.8%	6.6%	4.0%
1-2 months	16.7%	27.0%	15.1%
3-4 months	28.2%	38.1%	42.6%
5-6 months	24.4%	16.4%	25.1%
7-12 months	15.4%	6.6%	8.4%
Over 12 months	5.1%	1.3%	2.4%
Not sure	6.4%	4.0%	2.4%

What are the main long-term impacts your organization expects GenAI will have on software development over the next five or more years? (Please select up to three answers) - Selected Choice

Legend: APAC (dark red), Americas (red), EMEA (gray)

	APAC	Americas	EMEA
A new type of developer will emerge with specialized AI skills, such as prompt engineering, to work alongside AI technologies.	48.7%	46.5%	47.8%
Most developer responsibilities will involve reviewing and refining AI-generated code and solutions.	39.7%	44.7%	42.6%
Developers will spend more time addressing errors and issues arising from code generated by AI systems.	25.6%	36.7%	27.5%
There will be an increased demand for professional developers to work alongside AI technologies and manage complex development tasks	50.0%	45.1%	44.2%
There will be a reduced need for professional developers as AI becomes more capable of handling development tasks independently.	37.2%	35.8%	27.5%
Citizen developers and individuals within non-technical roles will play an increasingly significant role in creating and managing software solutions with the assistance of Generative AI, expanding the pool of contributors to software development efforts.	38.5%	35.8%	35.1%
Other (Please specify)	0.0%	0.0%	0.0%
We will not be using GenAI for software development	3.8%	1.3%	0.8%
Not sure	2.6%	1.8%	1.2%

Moreover, 94% of companies surveyed said they planned to increase their investment in AI in the next two years, indicating it will continue to be a driving force of innovation in the industry.

Consider the most well-established use cases for AI:

- **75% said they used AI tools for testing and quality assurance,** both of which involve a variety of routine and otherwise labor-intensive processes.

- **70% said they used AI tools for security-vulnerability detection,** even though security and privacy fears also happen to be among the biggest barriers to adoption.

- **Around half of executives said they used AI tools for other development and SDLC processes,** including application maintenance, user-experience design and coding assistance.

"From a software-testing perspective, AI provides broader coverage," said Michael Harper, managing director at KPMG U.S. "It's a journey that started years ago, long before the current wave of GenAI. Now we're seeing new capabilities, such as generating code from user stories. As these new use cases become more widely accepted in organizations, we'll start seeing an impact across the entire SDLC."

Unsurprisingly, the potential role and effect of GenAI are now top of mind for software executives. More than three-quarters of respondents said 10% to 50% of code in final products was now developed with the help of GenAI tools.

Almost half of executives said they expected GenAI to greatly affect user-interface design and development, documentation, application maintenance, and low/no-code development over the coming years.

"What I find surprising is that there isn't more investment in AI in other parts of the SDLC," said Rodrigo Coutinho, co-founder and director of data science at OutSystems. "Code generation and testing are essential parts of the process, but many other areas can also benefit from these new technologies. There's a lot to do in analysis, design, deployment and maintenance, and our results show that IT leaders consider these important. I'd expect more experimentation and advancements in the adoption of AI in these areas."

Despite the rapid advancements and potential benefits of AI, many enterprises are still in the early stages of implementation, suggesting lingering barriers and substantial room for growth and improvement.

This is due, in part, to the speed and sprawl of AI — especially GenAI. A third of respondents said they had a backlog of between 150 and 800 use cases for GenAI. Moreover, 68% of enterprises said they used between three and 10 distinct tools for software development and SDLC management.

The ever-rising pressure to reduce development time, while maintaining quality assurance and security, has made it hard for software executives to keep up. More than half of enterprises now use AI services from independent software vendors or hyperscalers, a trend that has also highlighted concerns

regarding AI sprawl. "It's important to carefully manage costs associated with these services to avoid escalating expenses and ensure that AI deployments are strategic and cohesive," said Takin Babaei, principal marketing manager at OutSystems. "Otherwise, you end up with fragmented AI initiatives that could lead to inefficiencies and increased complexity."

Aside from cost management, other barriers to the more widespread adoption of AI include the need to upskill employees, address security concerns, and keep up with evolving regulatory directives and ethical standards. However, by overcoming these barriers, early adopters have set the stage for far more advanced applications that clearly demonstrate the value and effect of AI in SDLC management.

GenAI is driving the next paradigm shift in software development

GenAI is in its breakthrough year for software development. Seventy-one percent of software executives said they used or planned to use these tools for software testing as an extension to the other AI-powered solutions many have been using for years. However, the potential of GenAI clearly spans far beyond these well-established use cases.

"What excites me the most is these technologies' ability to transform the relationship between developers and users," Coutinho said. "By using AI to reduce the time it takes to build an app prototype, the feedback process can start much sooner. Developers will have a deeper understanding of what stakeholders really want, and stakeholders will have a clear vision of what's feasible and where the project is heading. More importantly, the feedback will be timely, allowing developers to act without compromising the project budget and deadlines. The end results are faster innovation, better applications, higher adoption and healthier relationships across the business."

Rather than being restricted to automating repetitive SDLC management processes, GenAI can also become a valuable assistant in the creative process. About 3 in 4 software executives claimed that between 21% and 60% of their code would be developed with the assistance of GenAI within the next five years, indicating growing trust in the technology's capabilities.

Consider the most popular emerging use cases for GenAI in software development:

59% said they used or planned to use it for DevOps optimization, such as automated deployment or resource-management optimization.

58% for code generation, such as suggesting code snippets during development, creating initial code drafts from user stories or auto-generating boilerplate content.

56% for documentation, such as creating user manuals, summarizing development discussions or generating API documentations.

50% for user-interface design, such as auto-generating common UI components, designing layout prototypes, or providing style and design recommendations.

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Risk awareness, however, has to play a role in AI adoption. Without caution and strategy, tech debt could mount in the form of orphan code and hallucinations, a lack of context for an organization's specific coding needs, and scalability concerns. With strategy baked into AI in SDLC processes, 56% of respondents said they experienced or expected to experience a higher quality of applications, with fewer bugs and improved performance. Other highly anticipated outcomes include improved user satisfaction, simplified deployment and maintenance, and lower overall costs.

Confidence will likely increase as AI becomes more sophisticated and strategically integrated across the broader SDLC. However, as organizations rely more on AI-assisted coding, explainability will become far more important for maintaining quality control. Developers will need to maintain comprehensive audit trails to understand how and why AI draws the conclusions it does, highlighting the growing need to keep humans in the loop throughout the SDLC process.

"There are a lot of different perspectives that need to be considered when implementing AI solutions," Harper said. "Risk management, compliance, legal and others. Everyone needs to have their seat at the table. It's essential to have the right mix of understanding, and that leaders clearly communicate the need to innovate and push forward with the benefits. But, at the same time, everything needs to be measured with the right approach to risk." To address this need, Harper recommends using visual modeling and low-code development solutions to help verify AI-generated outputs. This potentially provides greatly improved AI explainability compared with manually poring over thousands of lines of code.

However, while executives have high expectations for the effect of GenAI, there is also no denying the longer-term, industrywide effects, such as increasing demand for AI-related skill sets, not to mention a marked shift in developer roles.

Fears concerning privacy, security and job losses highlight the need for better governance

While many organizations have adopted AI to automate repetitive, lower-value tasks, GenAI opens the door to many more potential opportunities. However, some leaders still aren't adequately prepared for widespread adoption, with 56% citing data privacy and security concerns as the main barriers to adoption.

"This is ultimately a vendor-trust issue, so I recommend addressing it by looking at code like you would data," Coutinho said "**Not all code is born equal,** and there are different levels of confidentiality depending on what the code addresses. Start by using AI to help in non-mission-critical projects and in projects that aren't part of your competitive advantage. Then, analyze the gains in productivity, understand how the AI models work and open the usage of AI to developers working on your differentiating projects as you gain trust."

The results also identified several other significant barriers to the more widespread adoption of AI:

42% expressed concern about regulatory and compliance challenges, indicating that executives expect new legislation and industry standards governing the use of AI in the coming years.

39% cited limited availability of skilled personnel, indicating a widespread expectation that AI is not so much about replacing jobs as it is about redefining them.

38% cited difficulties in integrating GenAI into existing workflows, suggesting that many existing tech stacks and governance models are not ready for the new technology.
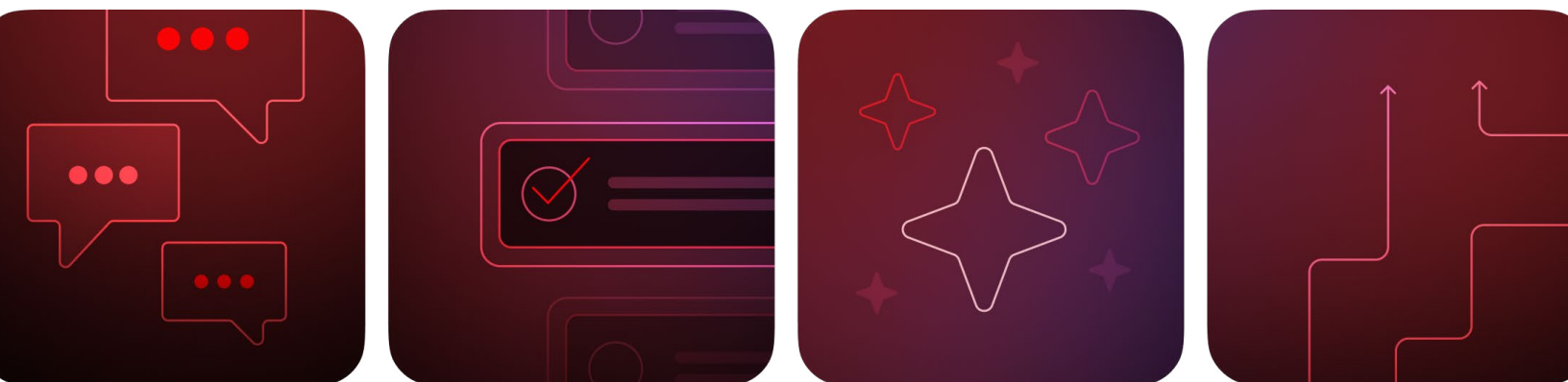
Underpinning these barriers is the fact that many knowledge workers use GenAI tools such as ChatGPT and GitHub Copilot, whether or not they've been explicitly sanctioned by IT.

Given that 79% of **enterprises have up to 300 use cases for GenAI in their backlogs,** IT has a great deal on its plate trying to prioritize effectively. This, in turn, has given rise to a new frontier in security, compliance and governance — suitably dubbed "Shadow AI." To help stem the rise of Shadow AI, many companies have banned or restricted employee use of ChatGPT other public AI tools at work.[2]

However, simply banning or restricting the use of specific GenAI tools is, for the most part, an ad hoc measure that enterprises take to manage risk. Few see it as a long-term solution, evidenced by the fact that almost all respondents expect to increase their investment in AI in the coming years.

In response, companies are creating their own GPTs and domain-specialized LLMs to govern AI use — the need for better governance is clear. Most importantly, the adoption of GenAI must center on ethical and responsible usage policies that proactively address the risks of Shadow AI.

"Change is hard, but it's coming, and for many organizations, it's already here," Harper said. "The barriers are real, and companies would do well to figure out the right approach to change management. They need to bring the right people on board so they have enough exposure to the technology in a way that doesn't add risk."

Organizations also experience pushback from employees, who are concerned about losing jobs to AI. These fears aren't unfounded; hence it is vital for leadership to communicate to employees that AI is not just about serving the needs of the business but the needs of their employees, too.

Companies want to meet employees where they are, which requires lenience in employees' AI use and, therefore, governance. Harper also emphasized the importance of clear communication, hands-on learning and continuous improvement. **"It's a matter of getting the trust and understanding that GenAI, while powerful, is not perfect.** So, you know, when you send your first couple of prompts, you may not get what you expect. It's important to experiment to get the results you want. It's an iterative process, and there's a learning curve to it."

It still takes most organizations three to four months to build applications that incorporate GenAI. This may be partly due to the fact that one-third of executives said they lacked confidence in the quality of AI-generated code.

To address these trust and confidence barriers, leaders must ensure that their AI tools offer explainability. Instead of being "black boxes," like most off-the-shelf AI tools, explainability helps us understand AI decision-making to better work in tandem with human decision-making. It is a fundamental requirement for implementing AI in a way that's responsible, secure, and compliant with future standards and regulations.

Fear of job losses also remains top of mind among employees in the software industry. It is important to remember — as well as to communicate — that AI is not meant to replace people but to augment their capabilities.

47% said they expected a new type of developer to emerge with specialized AI skills, such as prompt engineering, to work in tandem with AI.

43% said they expected developers' responsibilities to expand, which would include reviewing and refining AI-generated code and solutions.

Ultimately, a new type of professional developer will emerge because of AI — one equipped with specialized skills in AI — leading to AI and jobs evolving synchronously. Upskilling will be in order.

Early adopters report remarkable productivity gains, but some are still missing out

"93% of respondents are planning to increase their investment in AI over the next two years, indicating it will play a fundamental role in driving innovation and competitive advantage in the software industry."

Respondents broadly agreed that GenAI could enhance testing and quality control and improve software quality and drive informed decision-making. For those just getting started with incorporating AI into their SDLC processes, these are among the most tried and tested use cases. Then, once they become more accustomed to using AI in their SDLC workflows, they can apply what they've learned to building out additional use cases, such as coding assistance and user-experience design.

Seventy-nine percent of respondents said AI-driven automation had reduced development time by up to 50%, a figure that has a remarkable effect on the bottom line. Productivity and efficiency are the main drivers for expanding the use of AI throughout the SDLC.

However, while most are happy with the results of their AI implementations so far, respondents are aware of the potential effect of AI in low-code software development — the leading effect is on developers.

"Right now, the developer's role is shifting from code writer to code reviewer. LLMs are a big help, but they still make many errors and tend to behave like overconfident interns," Coutinho said. "As these models evolve and the trust in the resulting code improves, the developer's role will become more of an orchestrator and acceptance tester of AI work. The developer will act more as a manager of multiple agents, specializing in providing the correct instructions to the model and guaranteeing that the output matches the requirements."

The fear of missing out should never be the sole temptation to adopt AI. Like all business strategies, AI needs direction, and likely a lot of demystification. Upscaling AI in software development doesn't have to be a deterrent or fear. If executives bake awareness into their adoption strategy — employee involvement, compliance guardrails, reliable predictability in code — benefits will unfold.

Key takeaways

- **Prepare a long-term strategy for AI by iteratively expanding adoption with well-established use cases.**

- **Incorporate visual modeling and low-code workflows to enhance AI explainability and verify AI-generated outputs.**

- **Focus on upskilling employees to more effectively regulate AI usage and drive closer collaboration between developers and AI.**

Learn more →

Sources

[1] https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-ais-breakout-year

[2] https://fortune.com/2023/05/19/chatgpt-banned-workplace-apple-goldman-risk-privacy/

Methodology

The primary objective of this survey is to gather insights on AI and GenAI adoption in software development from IT executives and administrators. This survey was conducted between May 3 and May 16, 2024. The target population for this survey included 555 respondents who met the following criteria:

- Must hold a position of director or higher.
- Must work in the banking and financial services, insurance, government, manufacturing, health care, energy and utilities, technology, or retail industries.
- Must work in IT departments or functional roles.
- Must be employed at companies with a revenue of $50 million or more.
- Must be in the U.S., U.K., Japan, France, Canada, Australia, India or Germany.

About OutSystems

OutSystems was founded in 2001 with the mission to give every organization the power to innovate through software. The OutSystems high-performance low-code platform gives technology leaders and developers the tools to rapidly build and deploy their own business-critical applications. The company's network spans more than 700,000 community members, over 500 partners, and active customers in 79 countries across 21 industries. OutSystems is "The #1 Low-Code Platform®" and a recognized leader by analysts, IT executives, business leaders, and developers around the world. Some of the most well-known brands use OutSystems to turn their big ideas into software that moves their business, people, and the world forward.

Learn more at **outsystems.com/ai**

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