



# *New futures* **in focus**

**WORLD QUALITY REPORT**

**16th Edition | 2024-25**



IN ASSOCIATION WITH:



# World Quality Report

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# Introduction

Welcome to the very special 16th edition of the World Quality Report, which is recognized as the industry's largest research study to provide a comprehensive assessment of the current state of Quality Engineering (QE) practices from around the world and across different industries. Over the last 16 years, this report has tracked and examined the most important trends and developments in Quality Engineering & Testing by surveying 1,775 executives across multiple sectors and regions. It's a great honor for us here at Capgemini and Sogeti to publish this report, along with our strategic technology partner OpenText. We have ensured the topics covered are as wide and far-reaching as possible to give you forward-looking view of the latest trends, challenges, transformative initiatives, and disruptions shaping the world of quality and testing. In this report, you will see our key findings and recommendations for several key focus areas: QE in agile, QE automation, artificial intelligence and generative AI (Gen AI), data quality, intelligent products validation, and sustainability. The expert findings are further accentuated with commentary, examples, and best practices from 10 senior executives from various Fortune 500 organizations, who participated in deep-dive interviews around these topics.

## What's new?

In the previous edition, we observed the emergence of Gen AI adoption to augment our engineering skills, especially in the field of software and Quality Engineering. We saw an uptick in the investments made by organizations in AI solutions to drive the quality transformation agenda, however a significant number were skeptical about the value of AI in QE. The lack of focus on quality seen in the last few years brought back the emphasis on the Hybrid Testing Center of Excellence (TCoE) model. We saw a growing realization of the importance of quality in delivering value to customers. The complexity of the interconnected product landscape, rising demand for customer experiences, regulatory pressures, constantly changing guidelines, and cyber threats warranted a much more rigorous product testing focus. Lastly, a positive number of respondents showed eager intent to drive sustainability best practices in their organization.

This year we have seen a continuation of all these trends, but clearly one item that stands out is the impact and leverage of Gen AI for Quality Engineering. A large number of organizations are now moving ahead from experimenting to real scaled implementation of Gen AI to support Quality Engineering activities. We truly believe we will see further advancements in this area. The other striking result is that there is more acknowledgment of the importance of quality (or rather the risk and impact of insufficient quality) - but organizations still need to work to give true strategic attention to the topic of quality.

## WQR 2024 theme: *New futures in focus*

*New Futures* are the emerging realities driven by innovative advancements like Gen AI, automation, and human-in-the-loop systems. These technologies are not just tools but partners in the testing process, pushing the boundaries of what's possible in QE. Testing is no longer about validating present conditions; it is about preparing for and "rewriting" the dynamic, evolving future. *In Focus* suggests that while these possibilities are vast and boundless, clarity is essential.

As organizations navigate this transformative age, gaining insights into the future will require focusing on these emerging trends and testing strategies. This year's report serves as the lens through which leaders (and all readers) can examine, refine, and understand these changes. It's a call to action to focus on emerging trends and testing strategies to prepare for these new futures.



**Mark Buenen**  
Global Leader, Quality Engineering  
& Testing, Capgemini & Sogeti



**Sathish Natarajan**  
Group Vice President,  
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## All hands in

This report wouldn't have been possible without the significant contributions of many people. If you are one of the 1,775 executives across 33 countries who took part in this year's survey, we would like to thank you for your time and contribution in helping us gauge the prevailing moods and trends. We also have a special callout to the industry expert panel, whose insights have been valuable in illustrating the broader themes. We thank our partners at OpenText, our lead authors, and sector and regional subject matter experts (SMEs) at Capgemini and Sogeti, who together analyzed, interpreted, and provided expert commentary on the research data and interviews to build this report. In addition, we thank the report's production team; much work takes place behind the scenes to ensure this annual exercise bears fruit.

Finally, we thank you, our readers. It's your own experience and interest that gives the World Quality Report its reason for being. As ever, we hope this year's edition makes a rewarding contribution to your continuing efforts in software Quality Engineering, and that you can take advantage of these findings and recommendations to shape your Quality Engineering strategy, and perhaps even to challenge some of your current thinking.

The global technology landscape is constantly evolving with the importance of ensuring Quality Engineering while testing becomes essential in the development of software and applications. Because of this, OpenText is once again proud to sponsor and partner with Capgemini and Sogeti to produce the World Quality Report. This 16th edition, aptly titled "New Futures in Focus," provides insight into how 1,775 Quality Engineering professionals from 33 countries are adapting and moving their organizations forward in these exciting times.

It is evident that the use of emerging technologies in software development and delivery operations is no longer a goal, but a necessity. Gen AI and test automation are leading the way in meeting new and existing challenges, as well as increasing productivity and efficiency. This is highlighted by the fact that nearly three-fourths of the respondents are already using or plan to use emerging technologies for test automation. Most of this group are leaning to AI and Machine Learning (ML) to achieve this. To further amplify where we are in this revolutionary phase of software development, 68% of respondents are either actively using Gen AI or have completed pilots and are now crafting implementation roadmaps. Another drastic shift is the number of respondents that are not even exploring the use of Gen AI, which dropped from 31% in last year's report to 4% in this edition.

Among other drivers for accelerating test automation are cloud-native technologies and Robotic Process automation, with Gen AI and Predictive AI both playing significant roles. According to respondents, cloud-native technologies are appealing because they open the door to cost-effective solutions that eliminate the need for tooling licenses, which lowers overall operational expenses.

It is no longer a question of "if" AI and other emerging technologies will become a part of the DevOps fabric. We are in the early stages of a dynamic shift in the way we do business. It is almost a (if not an absolute) necessity to build a robust quality ecosystem or run the risk of being left behind. You can start revolutionizing Quality Engineering today by using Gen AI to experiment to determine which use case work best for your organizations. Also, another crucial step is to invest in workforce transformation to the emerging trends in digital and cloud migration strategies of the customers.

This report also pulls back the curtain on the role Quality Engineering is playing in sustainability, with a majority of organizations reporting it is a priority. It is a good sign that 58% of organizations prioritizing their efforts here. But there is still progress that needs to be made with only 34% implementing practices. Results also show there is a need to improve environmental impact measurement—an area that Quality Engineering can make a positive impact in the future.

One final note, I would like to express my appreciation and thanks to everyone at OpenText and Capgemini that has worked so diligently to create this edition of the World Quality Report.

We invite you to dive into the report to discover the many challenges and opportunities organizations will face in their endless pursuit of quality excellence as we put *new futures in focus*.



**Muhi Majzoub**  
Chief Product Officer, OpenText

# Executive summary

This year, the strategic importance of robust Quality Engineering practices has gained even greater recognition across all industries. Two key indicators underscore this trend:

First, the integration of quality engineers within agile teams has become a standard practice, with 40% of organizations now embedding these experts directly into their agile processes.

Second, we are witnessing a rise in organizations that not only integrate quality engineers into agile teams but also maintain dedicated Quality Engineering roles operating independently to ensure comprehensive coverage and oversight.

There is a clear need to align Quality Engineering metrics with business outcomes and showcase the strategic value of quality initiatives to drive meaningful change. On the technology front, the adoption of newer, smarter test automation tools has driven the average level of test automation to 44%. However, the most transformative trend this year is the rapid adoption of AI, particularly Gen AI, which is set to make a huge impact. Currently, 71% of organizations have integrated AI and Gen AI in their operations. Of these, 34% are actively utilizing Gen AI for Quality Engineering tasks, while another 34% have moved beyond experimentation and are now developing strategic roadmaps. The debate on which Quality Engineering & Testing activities will benefit most from Gen AI remains unresolved. This year's survey highlights a growing focus on leveraging Gen AI for test reporting and data generation over test case creation. We

anticipate further shifts in these expectations as the technology evolves rapidly in the coming months.

As businesses rely more heavily on automated, data-driven decision making, the quality of data is increasingly becoming a critical focus area. With 64% of organizations now rating data quality as critically important or of very high priority, the stakes have never been higher. Despite this recognition, many organizations are still in the early stages of effectively organizing ownership and implementing comprehensive quality management frameworks for their data. Addressing this gap is essential for ensuring that business decisions are based on reliable and accurate data.

Success with intelligent connected products requires a holistic quality strategy that drives competitive advantage and lasting customer loyalty. Hence, it's no surprise that intelligent product validation is gaining significance, with 21% of testing budgets now allocated to these smart technologies.

However, the industry faces significant challenges in validating protocols, AI models, and the complexity of validation of all integrations. Currently, many organizations are struggling to implement comprehensive test strategies that ensure optimized coverage of these critical areas. However, looking ahead, there is a strong expectation that AI will play a pivotal role in addressing these challenges and enhancing the effectiveness of testing activities in this domain.



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Over the past decade, the shift to Agile methodologies, cloud computing, and smarter technologies has transformed quality engineers into SDETs (Software Development Engineers in Test) and, further, into full-stack test engineers. The skill set requirements for quality engineers have now expanded even further, encompassing data proficiency, AI expertise, Gen AI capabilities, and product engineering skills. However, this evolution does not diminish the fundamental need for risk-based test strategies, human collaboration, and deep business expertise—elements that remain crucial for ensuring comprehensive and effective Quality Engineering.

A final area of focus in our survey is the progress organizations are making on sustainability and its validation. While 98% of companies recognize the critical importance of sustainability targets, there is a noticeable gap in defining and validating green IT initiatives. For instance, it's surprising that only about 25%

of organizations are currently measuring the environmental impact of their IT development. Even more concerning is the limited awareness among IT staff regarding sustainability targets and processes, which underscores the need for improved education and alignment within the industry to meet these crucial goals effectively.

In summary, the field of Quality Engineering & Testing is maturing rapidly, with AI technologies offering exciting new opportunities. However, the expertise and proactive involvement of quality engineers remain critical to achieving success.

We hope this year's report provides valuable insights into your progress toward improved and accelerated quality and offers actionable guidance to help you advance more swiftly.

# Key recommendations

## Quality Engineering in Agile

- **Adopt a product-aligned Quality Engineering structure:**
  - Integrate quality engineers directly into product teams to ensure their work is closely connected with product development and outcomes.
  - Set up “as a service” capabilities such as test data and test environment management for quality engineering functions that can be run as a shared service.
  - Maintain the independence of testing. As systems continue to increase in complexity with multiple technologies and hosting locations, the benefit of an independent testing team will pay dividends.
- **Shift focus to broader metrics:**
  - Move beyond measuring process efficiency and automation coverage.
  - Evaluate how Quality Engineering contributes to business objectives, such as customer satisfaction, revenue impact, and overall product quality.
- **Expand training beyond technical skills:**
  - Provide education in risk management to proactively address potential issues.
  - Include business understanding in training programs to align Quality Engineering efforts with organizational goals.

## Quality Engineering Automation

- **Develop an enterprise-wide QE Automation strategy:** Implementing a comprehensive QE automation strategy is essential for achieving consistency and driving cost-efficiency through optimal use of tools and technologies. This implies clearly outlining the objectives and desired outcomes of QE automation and pre-selecting the areas where to apply, increase or enhance test automation.
- **Leverage Gen AI for Automation:** Harness the potential of Gen AI to enhance and accelerate test automation. Gen AI goes far beyond the generation of automated test scripts and helps with the realization of self-adaptive test automation system, driving efficiency and effectiveness.
- **Focus on Business Performance Indicators:** Organizations must urgently identify, and leverage key business performance indicators influenced by QE automation, with a clear focus on business outcomes, such as increased customer satisfaction, reduced cost of business operations and others which are relevant to their business.

- **Rationalize QE Automation Tools:** Ensure that your QE automation tools are streamlined and capable of integrating with emerging technologies, such as Gen AI, to maintain compatibility and future-readiness.
- **Enhance QE talent and roles:** Reassess the current QE organization structure, whether central or federated, and incorporate more full-stack quality engineers and software development engineers in test to strengthen your team’s capabilities.

## Quality Engineering and AI

- **Start Now:** If you are not yet exploring or actively using Gen AI solutions, it’s crucial to begin now to stay competitive.
- **Experiment Broadly:** Don’t rush to commit to a single platform or use case. Instead, experiment with multiple approaches to identify the ones that provide the most significant benefits for your organization
- **Enhance, Don’t Replace:** Understand that Gen AI will not replace your quality engineers but will significantly enhance their productivity. However, these improvements will not be immediate; allow sufficient time for the benefits to become apparent.

## Intelligent Products Validation

- **Invest in AI:** Optimize testing by leveraging AI to ensure intelligent products are tested accurately and efficiently.
- **Upskill quality engineers:** Bridge the skill and talent gap by preparing Product Quality Engineers for evolving technologies.
- **Integrate Gen AI:** Employ Gen AI to create a blend of “digital testers,” enhancing efficiency to match the increasing development velocity.
- **Revise test strategy:** Adapt existing strategies to incorporate human testers for validating product quality aspects that AI and Gen AI cannot address, such as usability, bias, and exploratory testing.

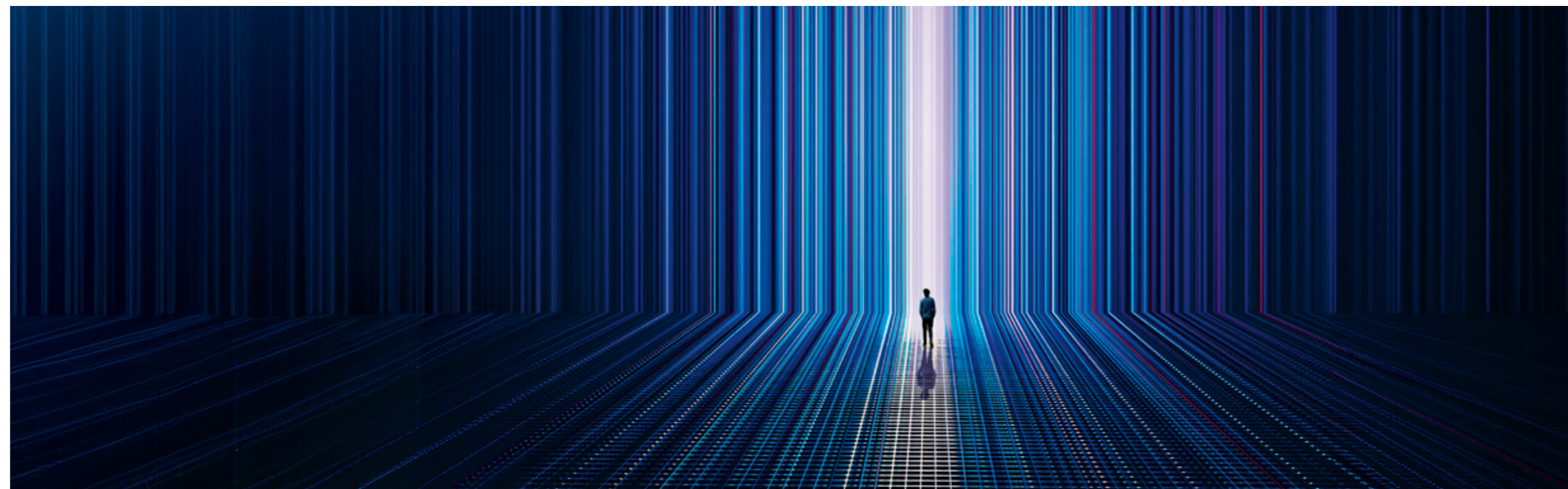
## Quality Engineering in Sustainability

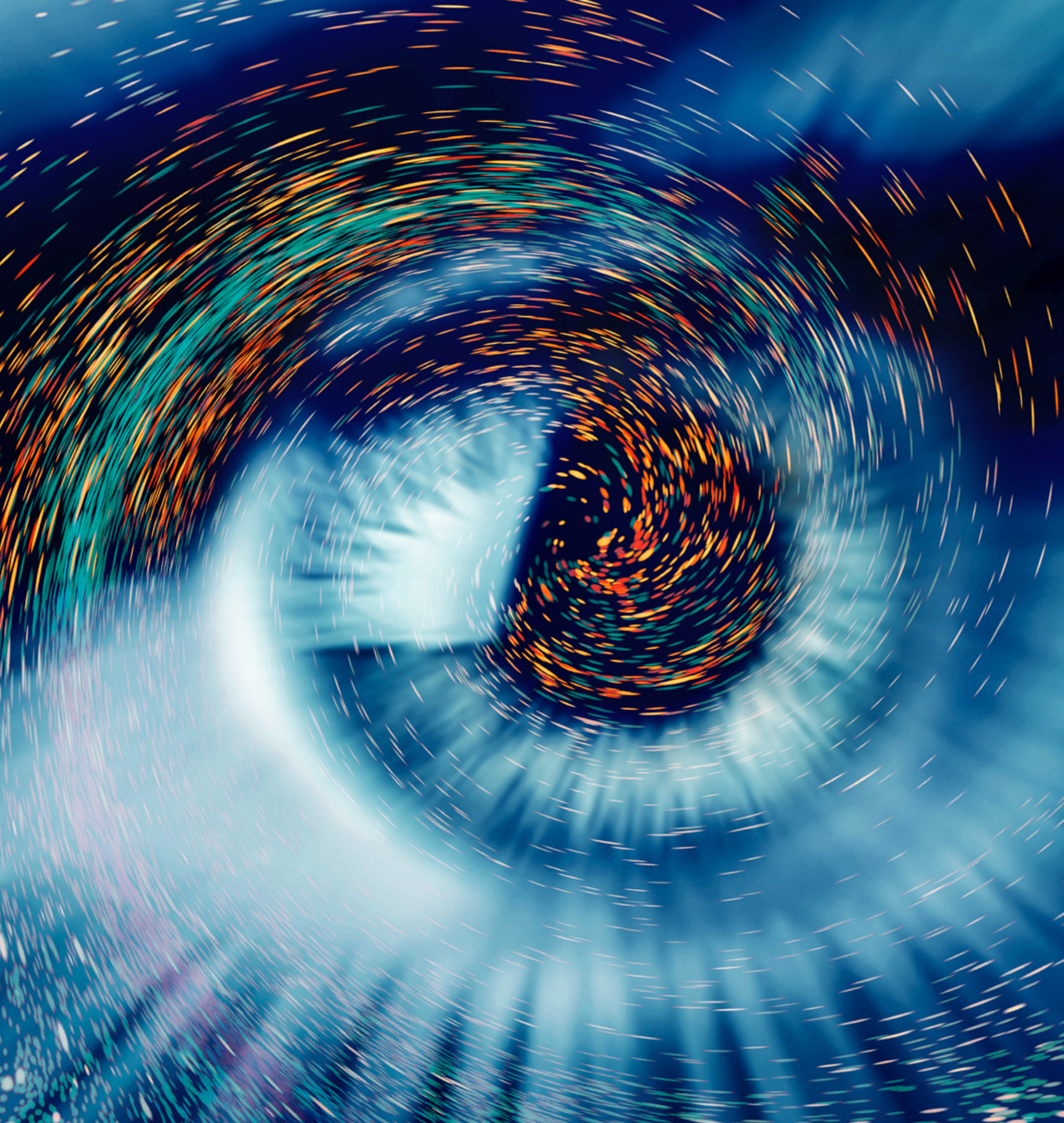
- **Define and track Green IT KPIs:** Establish clear and effective Green IT KPIs and track them diligently.
- **Measure environmental impact:** Develop comprehensive processes for measuring the environmental impact of all Quality Engineering activities, not just isolated parts.
- **Focus on key areas:** Prioritize validating compatibility of IT systems, and clearly identify and focus on the top areas for driving Green IT principles.

- **Practice sustainable testing:** Integrate sustainability into testing activities to advance organizational sustainability goals.
- **Increase awareness and training:** Invest in raising awareness and providing training on sustainability and Green IT practices across all IT staff.

## Data Quality

- **Clear ownership:** Establish clear ownership and responsibility for management and quality of all relevant data across the organization. This includes business related data, as well as your critical technical support data (which includes relevant test data).
- **Invest in quality data:** Invest in obtaining the best quality, bias-free data through AI tools to support better customer outcomes, and informed decision-making.
- **Embrace legal frameworks:** Fully embrace General Data Protection Regulation (GDPR) and similar legal frameworks to ensure compliance and protect data integrity.
- **Recognize data’s value:** Many organizations fail to appreciate the critical role data plays in their smooth operation. This mindset must change for better efficiency and decision-making.





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Data Quality

# Quality Engineering in Agile

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## The great reset: A new era for Quality Engineering

Heraclitus famously said, 'The only thing constant is change,' and this adage rings true in today's IT landscape more than ever. Last year, we witnessed a notable shift as software quality engineers increasingly collaborated with engineering and development teams. This trend is a standout feature in our latest World Quality Report, especially when it comes to the evolving skill set for software quality engineers.

Last year's report unveiled an intriguing insight; skills in development, such as Java, .NET, Python, and SQL—were considered far more crucial than traditional Quality Engineering skills like test automation and performance engineering. However, a new year brings with it...new focus.

The burning question is — has this alignment with development and engineering teams deepened, or has the industry shifted yet again? Indeed, there has been significant change, far more than we anticipated. Read on to discover our findings.

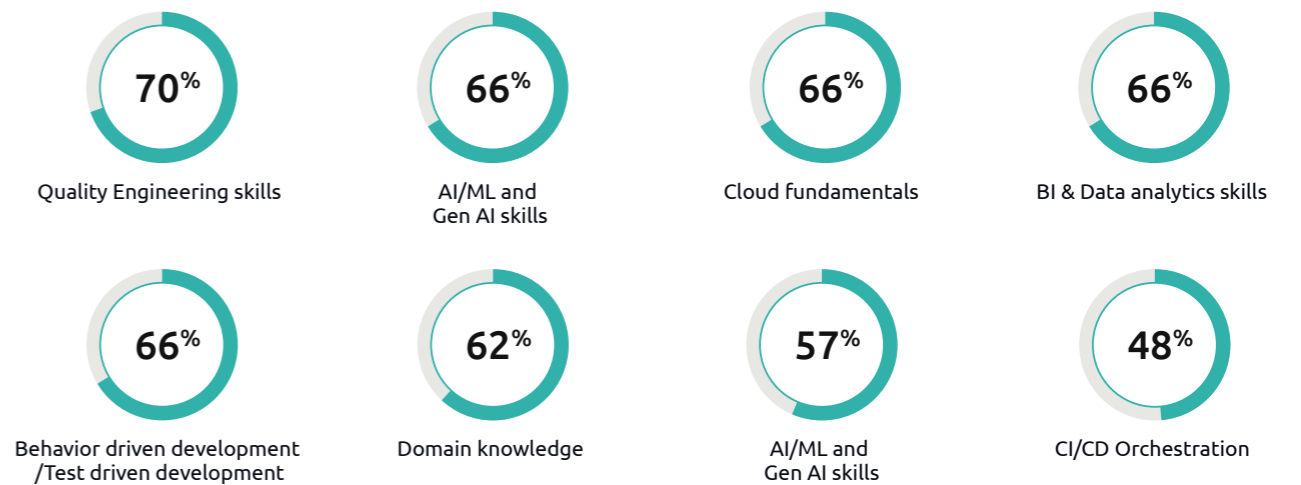


## Quality Engineering: Alive and kicking!

Fig 1 Top 5 skills for Quality Engineering associates

WQR 2024 - Global Results

What are the top five most critical skills for your Quality Engineering associates?



Gone are the days when Quality Engineering was just an afterthought. Today, it's at the forefront of innovation. According to this year's World Quality Report survey- coding and Continuous Integration (CI)/Continuous Delivery (CD) orchestration skills, once considered essential, now rank as the least critical, with only 57% and 48% of responses respectively. In contrast, Quality Engineering (70%), Artificial Intelligence (AI)/Machine Learning

(ML), and Gen AI skills (66%) have surged to prominence, reflecting a clear shift in priorities.

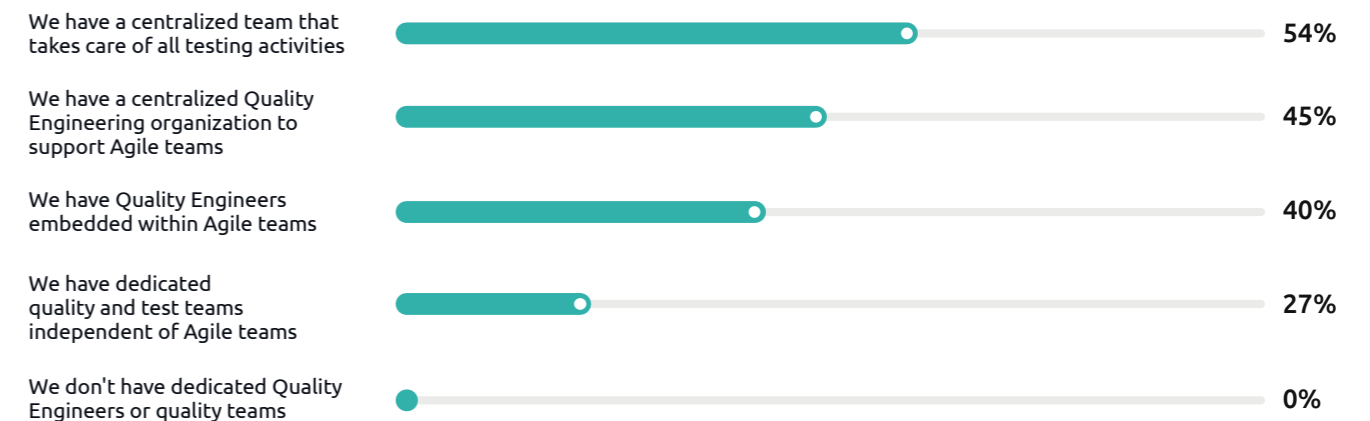
This pivot suggests that the development-focused approaches of the past have indeed delivered their expected outcomes. This compels us to ask ourselves - *Is Quality Engineering undergoing a reset?*

## Agile Quality Management maturity: Navigating the transformation

Fig 2 Set up of Quality Engineering for agile projects - NOW

WQR 2024 - Global Results

How is your Quality Engineering organization set up to support agile projects today?



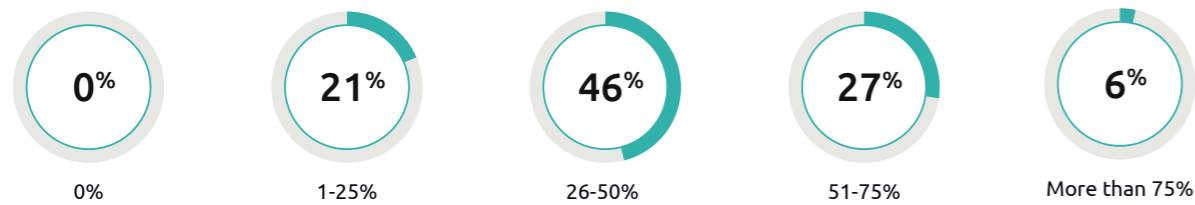
This year's survey reveals a significant shift in how organizations align their Quality Engineering practices with Agile methodologies. A notable change is the decrease in the use of traditional Testing Centers of Excellence (TCoE), with only 27% of respondents reporting their continued use. This marks a substantial drop from the 70% who relied on TCoEs last year. While the results from last year's survey seem high, likely due to conflicting interpretations of "TCoE", the decrease this year is clear and consistent with other survey responses. Concurrently,

40% of respondents now have quality engineers embedded within Agile teams, highlighting a trend towards embedding Quality Engineering into Agile workflows.

This indicates that the Quality Engineering industry for Agile development is still evolving. As critical skills continue to change, another question crops up: *What new changes and challenges lie ahead?*

**Fig 3** % of Quality Engineering associates embedded in Agile teams WQR 2024 - Global Results

What percentage of your Quality Engineering associates are embedded within Agile teams?



Average **43%**

While many organizations anticipate maintaining their current models over the next two years, there is one notable exception. This suggests a growing recognition of the need for quality engineers who can operate independently of Agile teams, while still contributing to overall quality objectives. In fact, the number of standalone quality engineers is expected to increase from 27% to 38%.

We also find that the focus on cross-skilling to align quality engineers more closely with Agile teams appears to have paid off. This year's survey results show that organizations have made considerable progress in upskilling their teams—only 16% of

respondents now view a lack of skills as a major bottleneck, a significant improvement from last year's 37%.

Organizations have invested heavily in equipping their Quality Engineering teams to work seamlessly with development teams. This investment has led to greater maturity in the field, but ongoing evolution and adaptation will be critical to overcoming future challenges and continuing to drive progress in Agile quality management. By staying agile and adaptable, organizations can ensure their Quality Engineering teams are always ready to meet new challenges and drive innovation.

## The strategic dilemma: Bridging the gap between perception and value

**Fig 4** Challenges for Quality Engineering adoption in Agile lifecycle WQR 2024 - Global Results

What are your biggest challenges for Quality Engineering adoption into the Agile lifecycle?



The most significant challenge facing Quality Engineering organizations today is the perception that it is not a strategic function. This concern was highlighted by 56% of respondents in our survey. Despite varying challenges across regions and sectors, it's disheartening to see this contradiction continues to persist.

One can assume that the shift towards a dev/test model may have contributed to this concern. As development skills have become less critical and the focus has intensified on Gen AI and core Quality Engineering competencies, it appears that the broader value of Quality Engineering is not being fully

recognized. The core problem may not lie in the alignment with development teams, but rather in demonstrating tangible value. Despite an increase in the use of advanced technologies like Gen AI and expanded automation coverage, the perceived value of Quality Engineering remains underwhelming.

To address this, organizations need to shift towards metrics that highlight business impact—such as revenue growth, customer acquisition, and overall business performance. By aligning Quality Engineering metrics with business outcomes, organizations can better showcase the strategic value of their quality initiatives and drive meaningful change.

Key challenges in Quality Engineering adoption

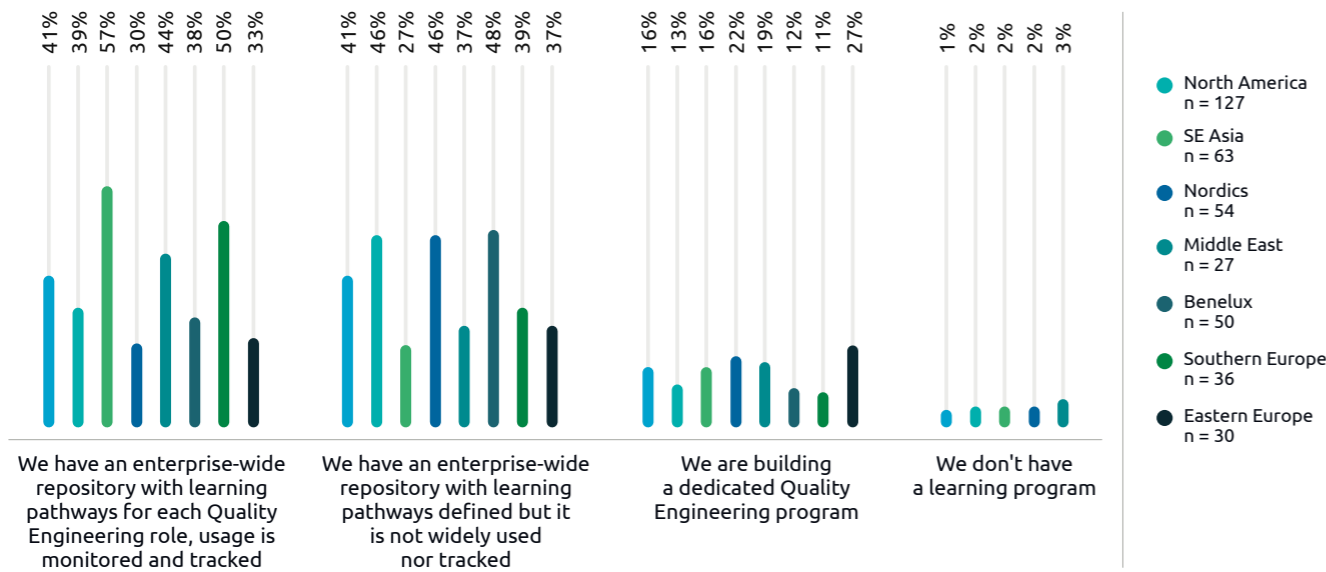
- **Quality Engineering is not viewed as strategic:** 56% of respondents identified this as their biggest challenge, followed closely by the inadequacy of current Quality Engineering processes for Agile (53%).
- **Increase in learning programs but lack of monitoring:** There was an overall increase in the percentage of respondents who have dedicated Quality Engineering pathways but over half of respondents either don't track the usage and effectiveness of such programs, or don't have any altogether.
- **Constant reprioritization of skills:** The IT industry is rapidly evolving as new technology or regulations come to light, the same is true for the required skills of quality engineers. This rapidly evolving skillset creates challenges upskilling quality engineers to be proficient in the ever-changing technology landscape.



## Upskilling for the future: Elevating Quality Engineering through learning

**Fig 5** Dedicated focus on learning and upskilling for the quality engineers WQR 2024 - Global Results

Do you have a dedicated focus on learning and upskilling for your quality engineers?



Continuous learning and upskilling are critical in Quality Engineering. Our recent survey reveals that 82% reported having an enterprise-wide repository with learning pathways for Quality Engineering roles; however, only half of them track the usage.

The number of respondents with dedicated learning pathways for quality engineers is encouraging, but there is a need for an increase in tracking and monitoring the usage of those pathways. Southeast Asia and Southern Europe lead in training, with over 50% of organizations effectively tracking usage. The Consumer-Packaged Goods, Financial Services, and Telco/Media

sectors prioritize training, with over 50% having and tracking comprehensive programs. Conversely, the Transportation sector lags, with less than 20% meeting this benchmark.

These insights shine a light on the importance of not only providing training, but also ensuring its effective utilization. To truly elevate Quality Engineering, organizations must focus on both the availability and the impact of their training programs for quality engineers.

### Our key recommendations

#### Adopt a product-aligned Quality Engineering structure:

- Integrate quality engineers directly into product teams to ensure their work is closely connected with product development and outcomes.
- Set up "as a service" capabilities such as test data and test environment management for quality engineering functions that can be run as a shared service.
- Maintain the independence of testing. As systems continue to increase in complexity with multiple technologies and hosting locations, the benefit of an independent testing team will pay dividends.

#### Shift focus to broader metrics:

- Move beyond measuring process efficiency and automation coverage.
- Evaluate how Quality Engineering contributes to business objectives, such as customer satisfaction, revenue impact, and overall product quality.

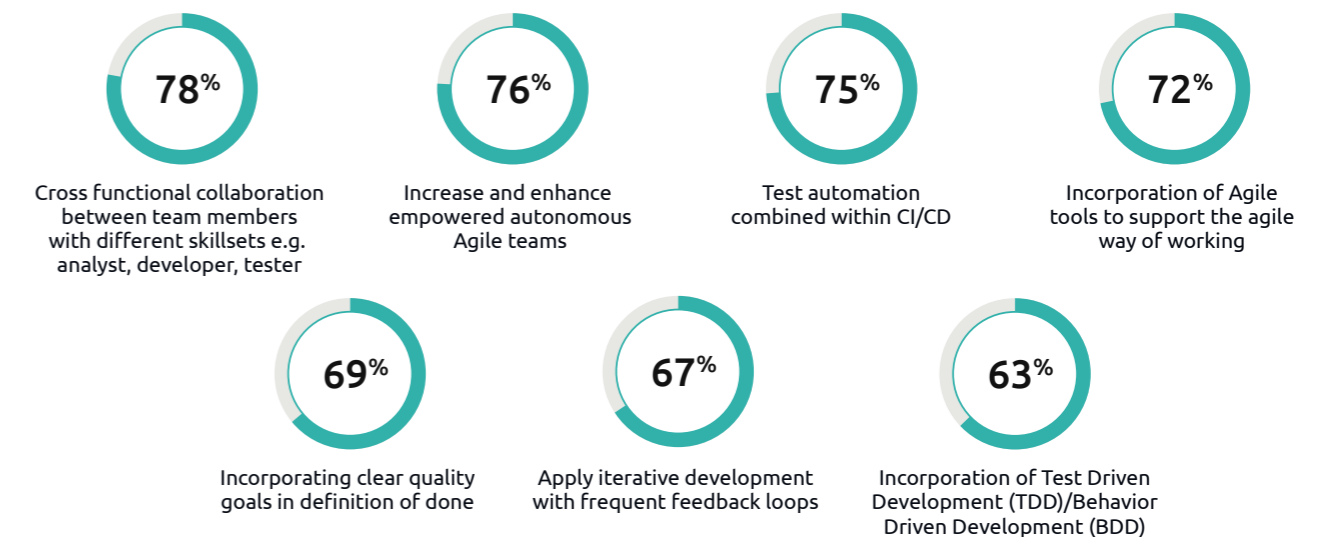
#### Expand training beyond technical skills:

- Provide education in risk management to proactively address potential issues.
- Include business understanding in training programs to align Quality Engineering efforts with organizational goals.

## What lies ahead?

**Fig 6** Most critical aspects in delivering better quality faster WQR 2024 - Global Results

For your organization, what are the most critical aspects for Agile teams to deliver better quality faster?



We also notice a continued rise in the integration of quality engineers within Agile teams. This year, 79% of respondents report having greater than 25% of their quality engineers embedded within Agile processes—a percentage that has been progressively rising over the years. This shift highlights a continued move towards Agile integration, with 78% of respondents emphasizing cross-functional collaboration as crucial for delivering better quality...faster.

As we dive deeper into the data, it's clear that the Quality Engineering industry is evolving. While more quality engineers are now part of Agile teams, there's a growing concern that this focus on Agile alignment might be overshadowing core Quality

Engineering principles. The emphasis has now shifted from traditional development skills to Gen AI and essential Quality Engineering competencies. This shift raises questions about whether the industry is overemphasizing agile at the expense of Quality Engineering fundamentals.

As we move forward, the balance between Agile alignment and core Quality Engineering principles will be essential in navigating this new era. The journey ahead promises further evolution, and in our upcoming chapters, we will explore how Gen AI is set to play a pivotal role in meeting the industry's ever-changing demands.

## Client Perspectives - Footlocker

*At Footlocker, we've adopted a - you build it, you own it philosophy. The right SMEs and scalable processes are essential for maintaining quality while accelerating development. However, while the tools often get the spotlight, they alone aren't enough. Effective processes and data-driven decision-making are paramount to minimize emotional bias and ensure that our quality metrics and strategies are grounded in reality.*

*In today's fast-paced IT environment, balancing people, processes, and tools is crucial. Accountability brings quality to the forefront, and we believe a centralized Quality Engineering practice is the best approach. We federate quality engineers to product teams, ensuring they are integrated but maintain a separation of duties. This setup fosters collaboration across our global, interconnected systems while preventing silos.*

*Recently, adopting Gen AI has presented a significant challenge, primarily due to talent scarcity and convincing leadership to invest. The niche skill set required for AI is difficult to source, and demonstrating ROI for AI investments is challenging without proven business cases. Security concerns also loom large, particularly for industries like banking and insurance, necessitating careful consideration of whether to use external AI solutions or develop in-house systems.*

*As AI continues to evolve, new roles in Quality Engineering, such as prompt engineers are emerging. However, finding individuals who excel in both AI and Quality Engineering is rare - given the different mindsets required for problem-solving versus solution creation.*

*As we navigate these complexities, we believe the need for robust performance engineering and reliable test environments have become even more critical. The reliance on third-party solutions highlights the importance of ensuring our systems work seamlessly within a complex ecosystem.*

### Sunita McCoy

Global Quality Leader for Platform Quality, Footlocker



## Client Perspectives - Barclays



*At Barclays, we understand that automation and DevOps integration are crucial in transforming Quality Engineering. Through our years of research and experience, we've developed a deep insight into how these advancements enhance productivity and efficiency.*

*One significant trend we've observed is the shift towards greater automation, including the integration of testing processes into CI/CD pipelines and the adoption of Agile methodologies. The 'shift left' approach, emphasizing early testing and analysis, has become crucial for catching issues before they affect go-live phases. We've also increasingly automated performance testing and incorporated observability into our engineering practices.*

*This transition necessitates an evolution in skill sets. Observability, achieved through developing pipelines for reports and dashboards, has emerged as a critical component of our work, alongside the increasing integration of Site Reliability Engineering (SRE) principles.*

*The substantial rise of open-source platforms has been notable, offering cost-effective solutions. However, in the banking sector, where security is paramount, traditional commercial tools like Dynatrace or AppDynamics continue to play a vital role due to their robust support and features. While open-source solutions will remain in use, the comprehensive capabilities and security of established commercial tools are crucial.*

*Looking ahead, we believe Gen AI holds promise for enhancing open-source solutions, particularly in reporting, dashboarding, and metrics collection. However, integrating AI requires careful management to address scalability and security concerns. In the short term, we might experiment with AI-enhanced open-source solutions, but we feel that platforms with built-in AI capabilities will ultimately offer a more secure and comprehensive solution for the long term.*

*At Barclays, we balance innovation with stringent security measures to ensure we stay ahead in this evolving landscape.*

### Manik Sikka

Global Lead for Performance Engineering, Barclays

# Quality Engineering Automation

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## Vaideshwaran V

Automation CoE Lead, Quality Engineering & Testing, Sogeti India

## The new future in Quality Engineering automation

We're standing on the brink of a major evolution in Quality Engineering automation, where the focus is firmly set on the exciting new futures unfolding before us. The pace of innovation is staggering, with organizations transitioning from experimentation to groundbreaking implementation of AI-powered automation technologies in mere months.



Fig 7

### Adoption of emerging technologies for test automation maturity

WQR 2024 - Global Results

To what extent is your organization using emerging technologies (such as Gen AI) in enhancing the maturity of test automation?



In 2023, 69% of organizations were experimenting with innovative automation solutions like Low Code/No Code or AI-based automation frameworks. Fast forward to 2024, and the landscape has shifted by leaps and bounds. New futures are in focus - as 29% of organizations have fully integrated Gen AI into their test automation processes, while 42% are actively exploring its potential.

The trend is clear—the number of companies planning to adopt these technologies has jumped from 10% to 25%

in only a year. The evolution of Large Language Models (LLMs) and AI tools, particularly Copilot, have enabled their seamless integration into existing software development lifecycles, ushering in a new wave of efficiency and innovation in QE automation.

Dive in to explore how these advancements are shaping the future of Quality Engineering.

### Adoption of trends and technologies

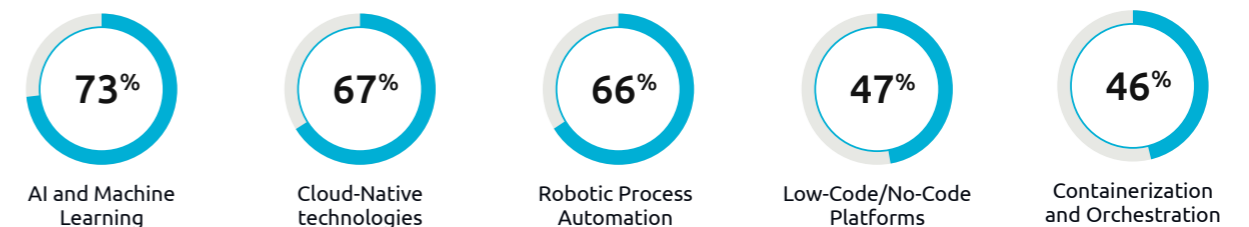
A significant 71% of organizations are currently adopting or have already adopted emerging technologies such as Gen AI in enhancing test automation.

Fig 8

### Top 3 emerging technologies driving test automation advancements

WQR 2024 - Global Results

What are the top three emerging technologies driving advancements in test automation?



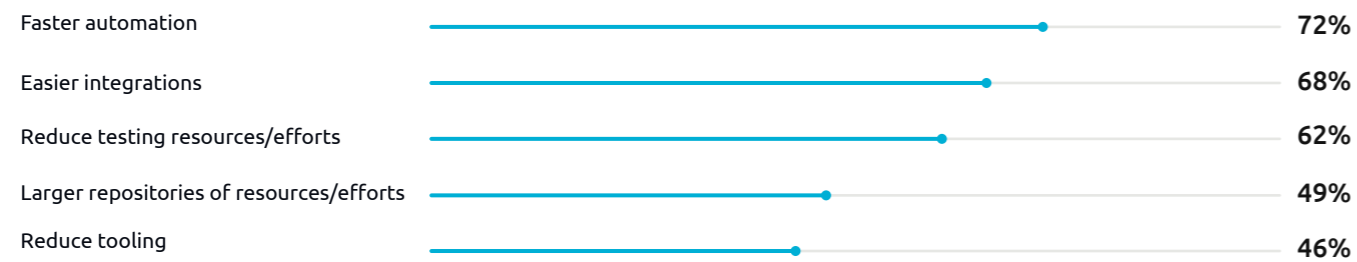
Among these, 73% are specifically leaning toward AI and ML. Right on their heels, in the race to the future, are cloud-native technologies (67%) and Robotic Process Automation (66%), both leaders in accelerating test automation. In particular, Gen AI and Predictive AI have emerged as especially prominent themes.

for commercial off-the-shelf tooling licenses. Despite 47% of respondents viewing Low-code/No-code platforms and containerization technologies as key to expediting automation, these tools still rank among the top five emerging technologies that enhance QE automation.

Cloud-native technologies offer cost-effective solutions, reducing overall operating costs by eliminating the need

**Fig 9 Top 3 benefits of using Gen AI to enhance test automation** WQR 2024 - Global Results

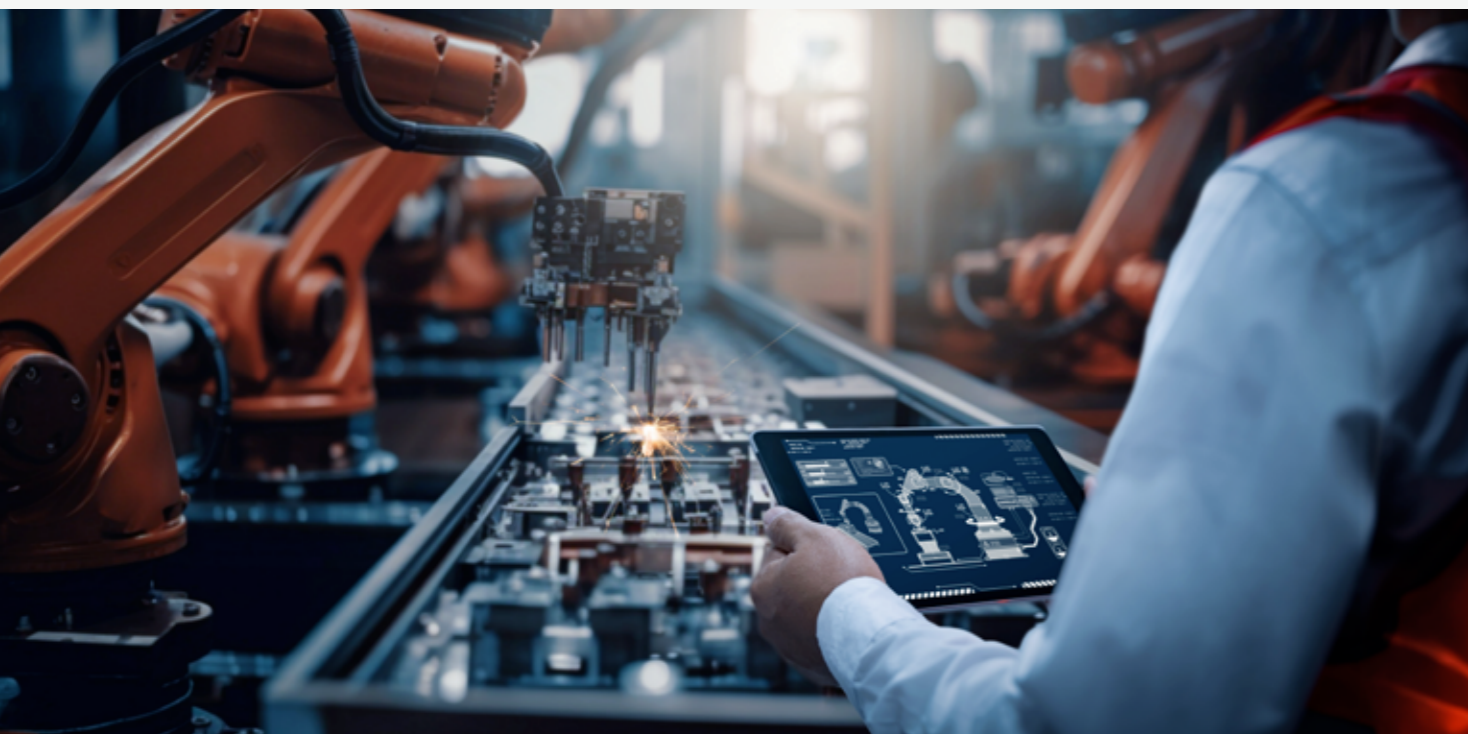
What are the top three benefits seen in using Gen AI in enhancing test automation?



Benefits are yet to be realized: 1%

### Key benefits of using Gen AI to enhance test automation

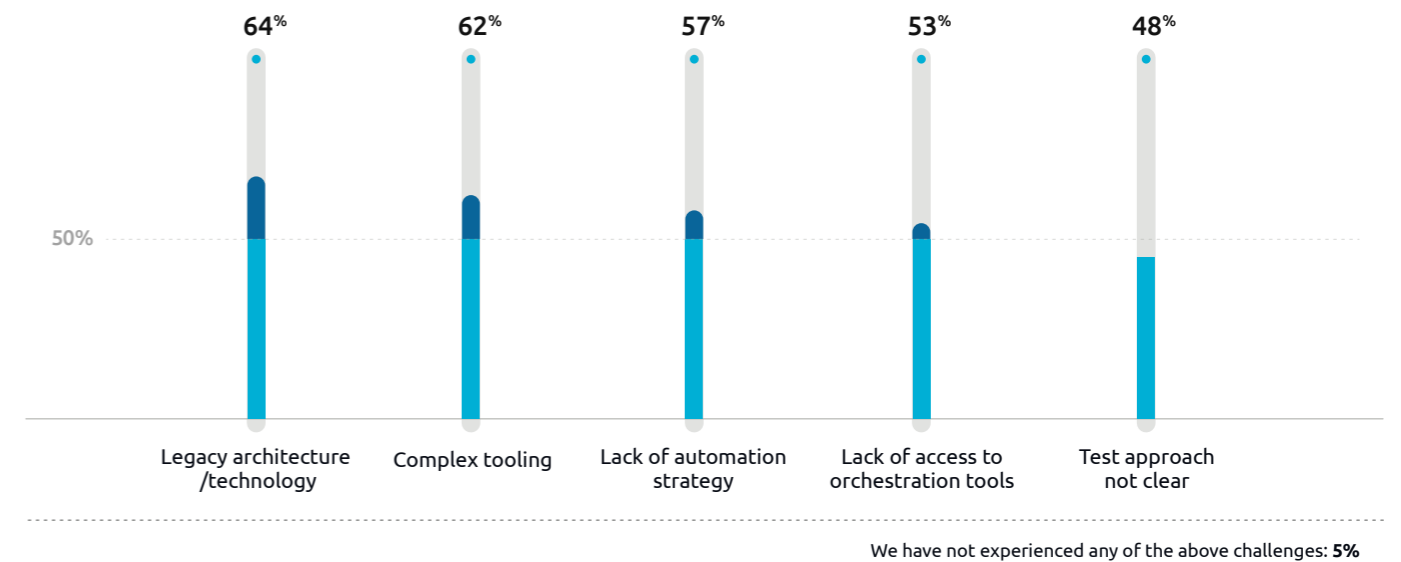
- **Faster automation (72%)**
- **Easier integrations (68%)**
- **Reduction in testing resource/efforts (62%)**



### Automation on the rise: Challenges in legacy systems and complex tooling

**Fig 10 Top 3 challenges in integrating test automation into CI/CD pipelines** WQR 2024 - Global Results

What are the top three challenges in integrating test automation to your CI/CD pipelines?

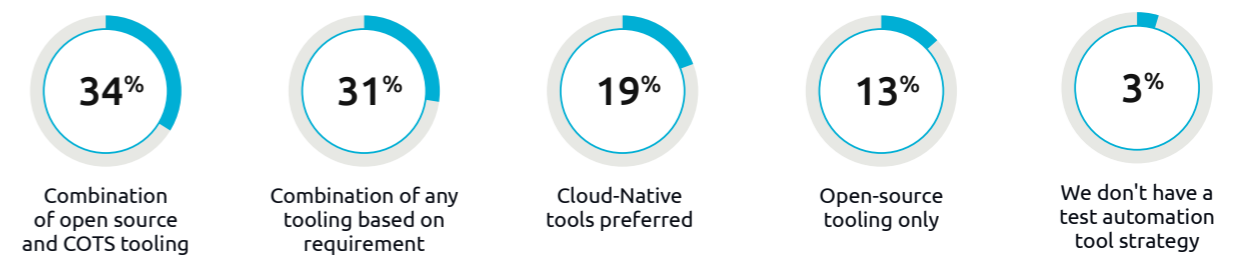


The survey results reveal that the global average level of test automation has now gradually increased to 44%. To better understand the factors hindering greater adoption of test automation, we carried out a survey to gather insights. The results revealed that 64% of respondents identified legacy

architecture as one of the top three challenges in integrating automation into existing DevOps pipelines. Interestingly, this challenge was also prominent in 2023, highlighting the need to modernize the overall architecture landscape to boost test automation adoption.

**Fig 11 Test automation tooling strategy** WQR 2024 - Global Results

What is your test automation tooling strategy?



Additionally, the overwhelming availability of test automation tools is making it challenging to identify the optimal solutions. This is a significant impediment to advance automation. Our survey found that 65% of respondents prefer a combination of open-source and commercial off-the-shelf (COTS) tools (34%), or tools that fit the specific requirements of the use cases being tested (31%). These insights highlight the importance of addressing legacy architecture and tooling complexities to drive higher levels of test automation adoption across organizations.

The challenges in test automation have remained consistent over the past years, but for the first time, the respondents acknowledge that the absence of a comprehensive test automation strategy is one of the critical obstacles. Notably, 57% of organizations acknowledge this gap, with fewer than 50% having an enterprise-wide strategy in place. This deficiency is a key factor contributing to the slower adoption of test automation.

**Fig 12 Mature repository of reusable test automation assets** WQR 2024 - Global Results

Does your organization have a mature repository (marketplace) of reusable test automation assets?

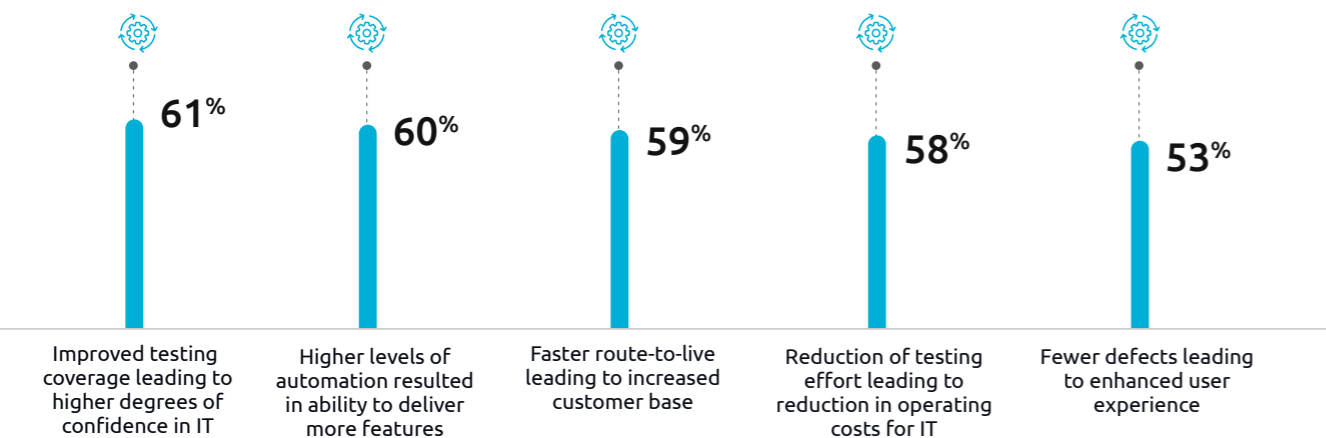


The lack of mature repositories further hampers advanced automation efforts. Only 44% of organizations have well-maintained repositories for reusable assets, while 50% either maintain them poorly (28%) or lack them entirely (22%).

### Strategy and execution: Aligning automation with business outcomes

**Fig 13 Top 3 business outcomes achieved through test automation** WQR 2024 - Global Results

What are the top three business outcomes achieved through test automation in your organization?



We have not experienced any of these business outcomes from test automation: 3%

The adoption of AI, particularly Gen AI, is on the rise in the world of QE. As we explore the business outcomes driven by QE automation, it is imperative that test managers and test leads prioritize these outcomes through effective automation strategies.

A recent survey revealed that 61% of CIOs believe improved testing coverage enhances confidence in IT systems. Furthermore, 60% of senior management reported that higher levels of automation have enabled the delivery of more

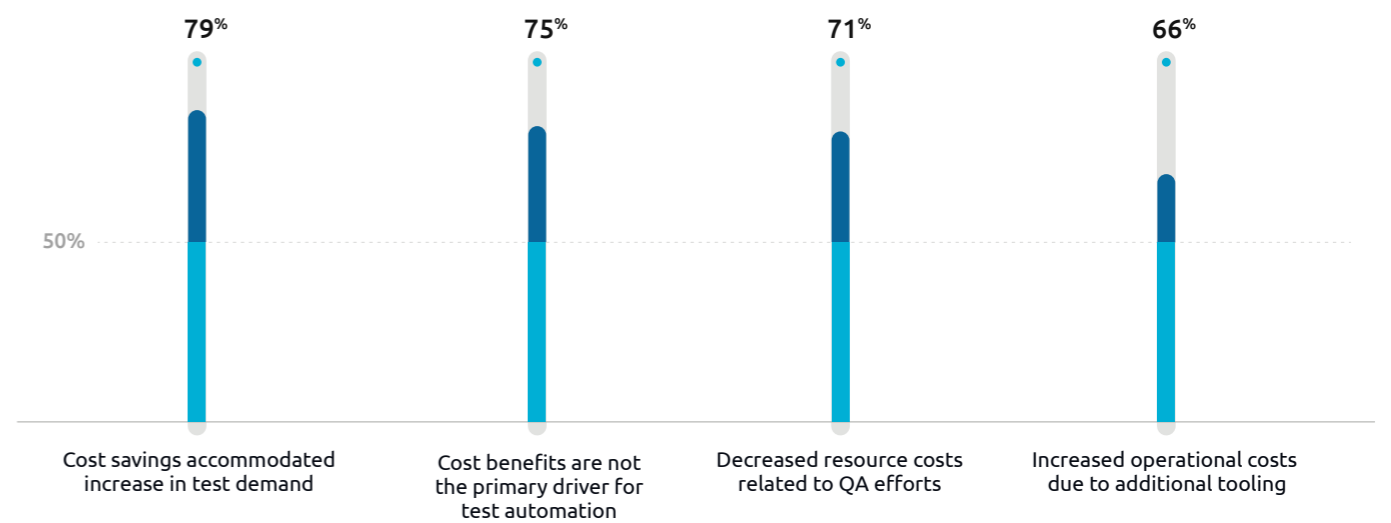
features. Additionally, 59% of CIOs indicated that increased automation speeds up the route-to-live, thereby expanding their customer base.

Over half of the respondents highlighted that automation reduces manual effort, leading to lower operating costs and fewer defects, which in turn enhances user experiences. Clearly, test automation significantly impacts time, cost, and quality, and there is a growing consensus on the need for increased automation adoption.

### Cost reduction as a key business outcome

**Fig 14 Top 3 direct QA cost benefits achieved through test automation** WQR 2024 - Global Results

What are the top three direct quality assurance cost benefits achieved through test automation in your organization?



We have not experienced any of these benefits from test automation: 3%

One of the key benefits of automation is reducing operating costs. Our analysis showed that lower costs allow businesses to accommodate more testing. However, 75% of respondents noted that cost benefits are not the sole driver for increasing test automation. Interestingly, the rise in tool costs due to increased

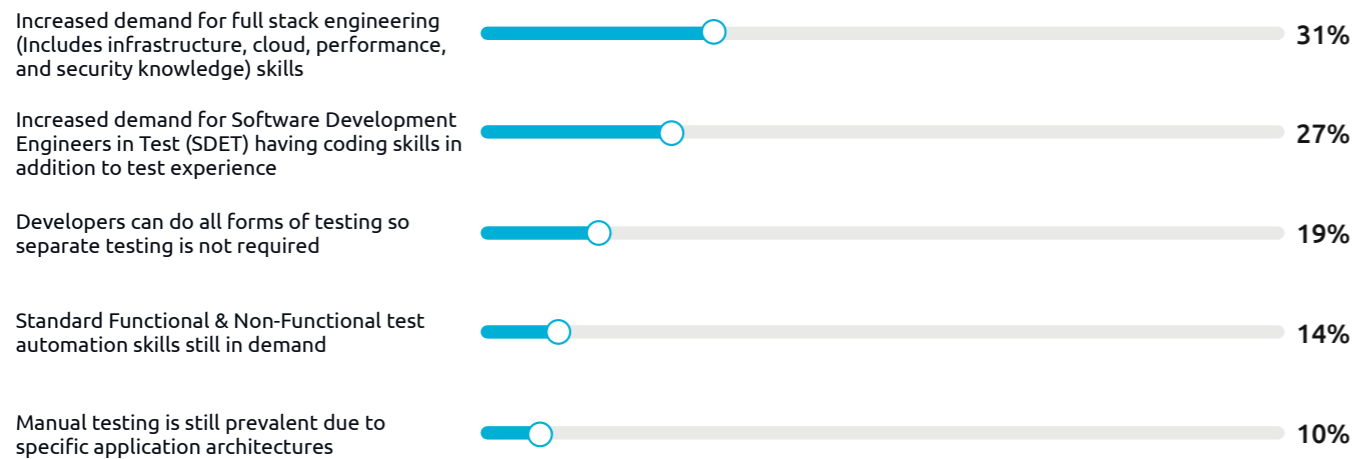
automation impacts operating costs, attributed to 34% of respondents exploring a mix of COTS tools and open-source options, or lacking an enterprise-wide automation strategy.

## Evolving skills to support automation trends

Fig 15 Evolution of automation talent requirements

WQR 2024 - Global Results

How are automation talent requirements evolving in your organization?



The industry is also focusing on the skills needed to support diverse technology and tooling requirements to enhance automation levels. In 2023, we found that the lack of skills was a major roadblock to automation. This year, 31% of respondents identified the need for full-stack engineers—quality professionals with additional expertise across the

technology stack, including infrastructure, cloud, performance, resiliency, and reliability. Additionally, 27% of respondents noted an increased demand for Software Development Engineers in Test (SDET), i.e., quality engineers who have coding skills in addition to test experience.

## Workforce development and skills

This year, we've observed a notable shift towards reassessing the fundamentals of end-to-end test automation strategies and tooling. Here's a closer look at the emerging trends:

- **Back to basics:** Many organizations are revisiting their core test automation strategies and tools, focusing on redefining their approach from the ground up.
- **Business outcomes over cost:** Organizations are increasingly focused on understanding how test automation contributes to overall business success.
- **Measuring success:** To truly succeed with test automation, measuring business benefits has become crucial. Companies are also scrutinizing whether their automation tools align well with their testing needs.
- **Leveraging AI:** Organizations are turning to AI to elevate their automation capabilities, integrating both open-source and commercial tools to enhance performance.
- **Upskilling for the future:** There's a growing emphasis on developing a versatile skill set among quality engineers and software development engineers in test. This upskilling aims to meet the evolving demands of automation and ensure successful delivery.

## Our key recommendations

- **Develop an enterprise-wide QE automation strategy:** Implementing a comprehensive QE automation strategy is essential for achieving consistency and driving cost-efficiency through optimal use of tools and technologies. This implies clearly outlining the objectives and desired outcomes of QE automation and pre-selecting the areas where to apply, increase or enhance test automation.
- **Leverage Gen AI for automation:** Harness the potential of Gen AI to enhance and accelerate test automation. Gen AI goes far beyond the generation of automated test scripts and helps with the realization of self-adaptive test automation system, driving efficiency and effectiveness.
- **Focus on Business Performance Indicators:** Organizations must urgently identify, and leverage key business performance indicators influenced by QE automation, with a clear focus on business outcomes, such as increased customer satisfaction, reduced cost of business operations and others which are relevant to their business.
- **Rationalize QE automation Tools:** Ensure that your QE automation tools are streamlined and capable of integrating with emerging technologies, such as Gen AI, to maintain compatibility and future-readiness.
- **Enhance QE talent and roles:** Reassess the current QE organization structure, whether central or federated, and incorporate more full-stack quality engineers and software development engineers in test to strengthen your team's capabilities.

## The path forward

As we traverse the ever-changing space of QE automation, it's clear that staying on top of AI-driven advancements is crucial for future success. Organizations must develop comprehensive automation strategies, align efforts with business outcomes, and invest in modern technologies and skilled personnel.

By addressing current challenges and leveraging the power of Gen AI, businesses can overcome barriers, enhance automation capabilities, and achieve significant improvements in efficiency, cost-effectiveness, and quality. The journey to advanced QE automation is not just about keeping pace with technology, but about leading the way into a new era of innovation and excellence.



## Client Perspectives - Leading Healthcare & Insurance Provider

*Quality Engineering is not just about testing; it's about ensuring excellence at every step. As a leading healthcare and insurance organization based out of the UK, we are continually adapting and moving beyond conventional testing methods to embrace an integrated quality strategy that aligns with our rapidly evolving technology landscape.*

*We feel that one of the major challenges in Quality Engineering today is keeping up with the fast-paced changes in technology. The digital-first approach demands that we maintain quality throughout the entire lifecycle of delivery, ensuring that it's understood and embraced by all stakeholders—from business to operations. This is often a missing piece in the puzzle, but it's crucial for delivering high-quality digital experiences.*

*To address these challenges, we recommend a broad skillset for quality engineers, which includes not only functional testing and automation but also a deep understanding of business and system architecture. It's this blend of technical and business knowledge that enables us to adapt to digital transformations and deliver high-quality products quickly and efficiently.*

*Automation remains a key focus, but we approach it with a strategic mindset. Instead of automating everything, we focus on identifying the right processes that deliver the best outcomes. This ensures that our automation efforts are value-driven rather than just ticking a box. We're still evolving in our automation journey, particularly in lifecycle automation, and we're keen to explore how Gen AI can enhance our processes.*

*We're committed to pushing the boundaries of Quality Engineering. By staying ahead of industry trends and focusing on delivering exceptional value to our customers, we ensure that our approach remains innovative and effective.*

### Shivaprakash Moolya

Quality Engineering Manager (UK), Leading Healthcare & Insurance Provider



## Client Perspectives - A Major Multinational Bank



*We recognize that prioritizing automation and synthetic data generation is crucial for boosting productivity and efficiency. By seamlessly integrating testing into our development pipelines, we streamline workflows and enhance overall effectiveness. Automation is central to this strategy, fostering reusable assets and closer collaboration between development and testing teams.*

*Looking toward the future, we see immense transformative potential in Gen AI for Quality Engineering. Our current exploration includes use cases such as creating test data, generating manual test cases, crafting automation scripts, analyzing requirements, scrutinizing defects, and assessing code coverage in relation to regression capabilities. This comprehensive approach enables teams to execute thorough regression cycles quickly with minimal manual effort.*

*Validating AI-generated outputs is critical. We recommend a semi-manual, semi-automated process where SMEs review and refine AI-generated test cases. Developing a strong feedback loop accelerates this process, balancing efficiency with accuracy and quality control.*

*Finally, sustainability should be at the core of every organization's Quality Engineering strategy. As we utilize infrastructure and resources, specialized teams initially focused on performance engineering should now emphasize on non-functional testing. This minimizes waste in terms of capacity and computing power, contributing directly to Green IT initiatives and aligning with broader sustainability goals.*

*Overall, we feel that the mindset within Quality Engineering is rapidly evolving. It's no longer just a step at the end of the development lifecycle; it's becoming embedded throughout the entire process, ensuring that we maintain quality from start to finish.*

### Kaushik Saha

TCOE Head, Citi Global Wealth Tech

# Quality Engineering and AI

## Andrew Fullen

Head of Innovation and Technology, Sogeti UK

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Portfolio Manager, Quality Engineering & Testing, Financial Services, Capgemini India

## Gen AI in action: Are organizations truly embracing the revolution?

Gen AI is shaking up Quality Engineering in ways that were once the stuff of science fiction. It is reshaping how teams make decisions, streamline processes, and discover new insights.

Abraham Maslow, who defined the famous pyramid of human needs, once said, "In any given moment, we have two options: Step forward into growth or step back into safety." This quote encapsulates the crucial decisions organizations face with the rise of Gen AI. As this technology weaves its way into our modern work culture, it's set to transform how organizations approach Quality Engineering. Embracing Gen AI offers a chance to innovate and grow, while resisting it may mean missing out on its potential impact.

The results from this year's survey indicate what we believe is the new future – Gen AI-augmented Quality Engineering. We found that 68% of respondents have moved beyond the experimentation phase and have adopted Gen AI platforms to improve their overall IT efficiency and accelerate their speed to market. Is the industry embracing this change wholeheartedly, or are some taking a cautious, wait-and-see approach? Read on to discover more.

## Adoption of Gen AI solution for Quality Engineering

Fig 16 Adoption of Gen AI solutions for Quality Engineering activities

WQR 2024 - Global Results

Has your organization adopted the use of Gen AI solutions (LLM and SLM models) like OpenAI, ChatGPT, or GitHub Copilot for Quality Engineering activities?



The message is clear: *Gen AI is not just the future—it's the present, transforming Quality Engineering before our eyes.* Organizations are increasingly adopting Gen AI and discovering its benefits in enhancing their Quality Engineering teams. Let's explore how this technology is transforming the field.

This year's survey shows a striking shift—a total of 68% of respondents are either actively using Gen AI (34%) or have completed pilots and are now crafting implementation roadmaps (34%). What's even more impressive, only 4% are not exploring Gen AI solutions this year, a sharp decline from 31% last year.

## Unlocking the power of Gen AI: What are organizations really using it for?

Fig 17 Most likely Gen AI use cases for implementation

WQR 2024 - Global Results

Which of the following Gen AI (LLM and SLM models) use cases are you most likely to implement?





It was surprising that most respondents identified Test Reporting (56%) and Defect Analysis (56%) as the top use cases to implement, with Knowledge Management (54%) being a close third. This is contrary to the use cases we have seen and implemented so far. Interestingly, Test Automation Script Creation (46%) and Test Case Generation (45%) were ranked as the least likely to be implemented, which differs from the trends observed in client conversations.

The introduction of Gen AI into the Quality Engineering space is still in its early stages. Most organizations currently leveraging Gen AI are experimenting with various use cases to identify which ones deliver the most significant benefits. Given the advanced tools and maturity in creating manual and automated test cases, it's natural for organizations to turn to Gen AI for improvements in test reporting and defect analysis, especially in areas where automation isn't as developed or mature. However, given the

amount of effort spent on test case and automation script design, there are greater gains to be made in those areas.

While reducing defects and cutting costs may not top the list of expected benefits from Gen AI, this reflects a deeper understanding of its true potential. Gen AI isn't about replacing the human touch or magically improving testing quality on its own. Instead, it's a game-changer for boosting the productivity of quality engineers. It accelerates the creation of test scripts—whether manual, automated, or performance-based, thereby making the entire process more efficient.

Interestingly, 56% of respondents revealed that using Gen AI for a competitive edge through innovation wasn't a priority. This may stem from a broader issue: *Quality Engineering often isn't recognized as a strategic asset.*

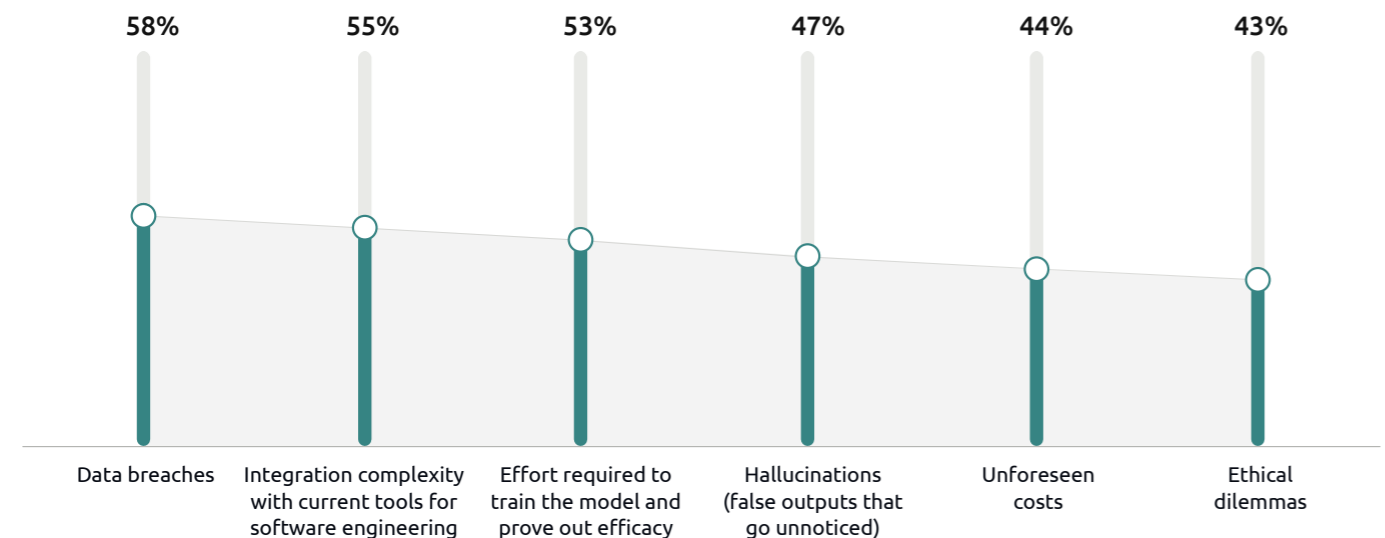
### Current use of Gen AI solutions (LLM and SLM models) for Quality Engineering activities

- Only 4% of organizations are not exploring Gen AI solutions, marking a significant decrease from 31% last year.
- 68% are either using Gen AI (34%) or developing roadmaps after initial trials (34%).
- Gen AI adoption is similar in the US (40%) and Canada (30%), but varies across Europe, with France at 26% and the UK at 44%.
- HiTech (41%) and Automotive (43%) lead in adoption, while Financial Services follows closely at 38%. Transportation trails with the lowest adoption at 12%.

### Challenges hindering Gen AI's adoption in Quality Engineering

**Fig 18 Biggest risk in leveraging Gen AI solutions** WQR 2024 - Global Results

What do you feel presents the biggest risk in leveraging Gen AI solutions for Quality Engineering?

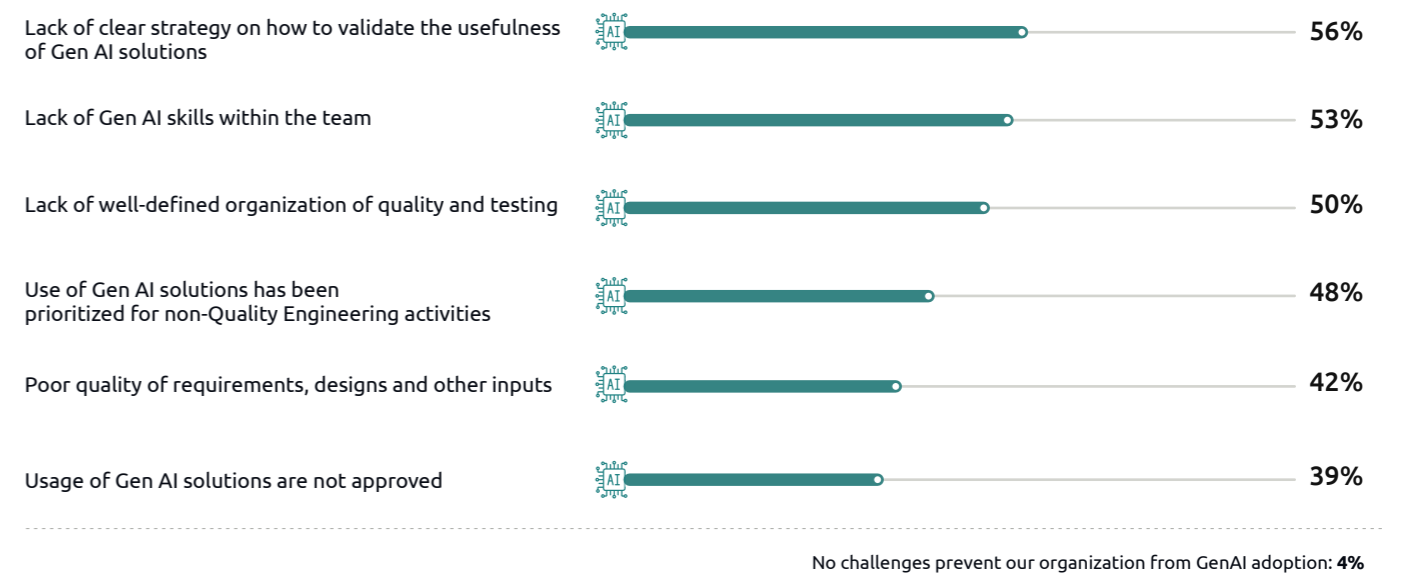


It's no surprise that data breaches (58%) continue to be the largest perceived risk from using Gen AI; integration complexity (55%) and hallucinations (47%) round out the top three. This is largely in line with what the report indicated last year. Interestingly, ethical

dilemmas (43%) rank lowest among concerns, likely because they have minimal impact on common use cases identified within the Quality Engineering space.

**Fig 19 Challenges in using Gen AI** WQR 2024 - Global Results

What challenges is your organization currently working through in regards to usage of Gen AI?



From a broader perspective, the most common challenges are a lack of clear strategies for validating Gen AI's usefulness (56%) and insufficient skills (53%). These issues highlight the emerging nature of Gen AI and its relatively immature integration into the software testing lifecycle. On a positive note, the use of

Gen AI for non-Quality Engineering tasks, though still a notable challenge, does not top the list. It ranks in the middle, with 48% of respondents identifying it as a significant concern, indicating that it is less critical than other issues but still requires attention.

### Our key recommendations

- **Start now:** If you are not yet exploring or actively using Gen AI solutions, it's crucial to begin now to stay competitive.
- **Experiment broadly:** Don't rush to commit to a single platform or use case. Instead, experiment with multiple approaches to identify the ones that provide the most significant benefits for your organization.
- **Enhance, don't replace:** Understand that Gen AI will not replace your quality engineers but will significantly enhance their productivity. However, these improvements will not be immediate; allow sufficient time for the benefits to become apparent.

## Where do we go from here?

Although the sheer volume of data may feel overwhelming, one thing is clear: Gen AI will revolutionize Quality Engineering. Whether you jump in headfirst or just dip your toes in, you need to start your adoption now!

Respondents have expressed interest in using Gen AI for test reporting and defect analysis. However, simpler use cases, such as manual test case creation and automation script development, offer a quicker return on investment and a lower-risk approach. We recommend starting with one of these simpler use cases. They align well with common development applications of Gen AI and can deliver more immediate and measurable results.

The jury is still out on which Gen AI solutions organizations will ultimately choose, with most indicating a preference for a

multi-platform approach for now. Both types of platforms—chatbots and prompt engineering—offer distinct advantages, so it's wise to continue exploring both until you find the one that best meets your needs.

Regardless of your chosen solution or use case, advancing beyond the proof-of-concept stage to full implementation is crucial. Ensuring that your team—including quality engineers, leadership, and other IT/business staff, is trained in the safe use of Gen AI and educated on distinguishing fact from fiction will be key to fostering a broader culture of adoption.



## Client Perspectives - A Multinational Insurance Company

*Quality Engineering is evolving as smarter, more efficient ways of working are embraced.*

*There is excitement about how Gen AI can create content and make test design easier and better. In the past, designing tests has always been a delicate balance of ensuring coverage without overcomplicating the process. With machine learning, problems can be spotted sooner, improving the ability to fulfill quality goals without compromising on quality or speed.*

*Gen AI will also help with a step change in the defect process. When data is input into the system, learning from it and predicting where defects might arise becomes possible. This makes the process smarter and more targeted, allowing for smarter work instead of just harder work.*

*One of the best projects across the Quality Engineering industry has been the creation of the Quality Engineering Charter. Collaboration with many industries tackled common quality issues. There's a lot that could be done together across industries, keeping the momentum through sharing ideas to learn and influence a change across the industry is a challenge. Working more across different industries could lead to new ideas that unlock groundbreaking solutions to the Quality Engineering challenges faced by all.*

*In the end, AI and machine learning have a big impact on how things are tested at our multi-national insurance company. These tools help make designs simpler, run fewer tests, and still provide customers with the top-notch quality they are looking for.*

### Michelle Christmas

Head of Quality Engineering of a Multinational Insurance Company



# Intelligent Products Validation

## Jeba Abraham

Practice Vice President, Quality Engineering & Testing, Sogeti USA

## Pepijn Paap

Principal Consultant - SAP/ERP, Quality Engineering & Testing, Sogeti Netherlands

## Product quality – The key to competitive edge and customer loyalty

Step into a world where everything—your gadgets, digital services, and even your daily routines are intricately interwoven. We're no longer passive users but active players in a network of connectivity, where seamless interactions are not just desired but demanded! Imagine getting a phone alert when your doorbell rings from halfway across the globe—what was extraordinary then...has become the norm now. Today, the key to business success hinges on creating seamless, unforgettable, and hyper-personalized experiences. These experiences not only build a competitive edge, but also foster lasting customer loyalty.

This evolution is prompting companies to embrace a product-centric approach to create connected experiences.

For a product to truly excel, it must seamlessly integrate into a larger ecosystem, interacting effortlessly with other products, services, and platforms. These smooth interactions are essential for delivering personalized and exceptional user experiences.

Success with these products hinges on a comprehensive approach to quality. This ensures that each product not only stands out, but also enhances the overall user experience. The outcome? Greater satisfaction, increased loyalty, and a substantial competitive advantage. In this chapter, we'll explore the importance of seamless integration and provide insights into building robust ecosystems that elevate the customer experience.

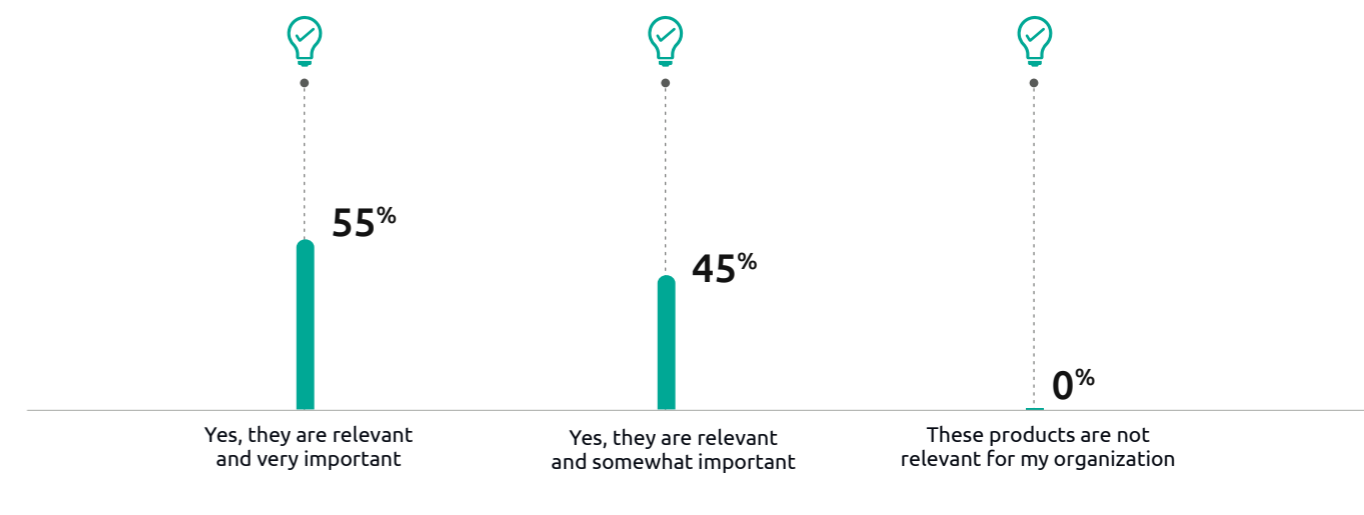


## Unlocking the power of connected products – Why validation matters?

Fig 20 Relevance of intelligent and connected product validation

WQR 2024 - Global Results

Are intelligent products and validation of connected products relevant for your organization?



Companies everywhere are starting to see just how important connected product validation is. In fact, more than half of the organizations (55%) we surveyed said it is important, with others acknowledging its significance (45%) and this focus is only going

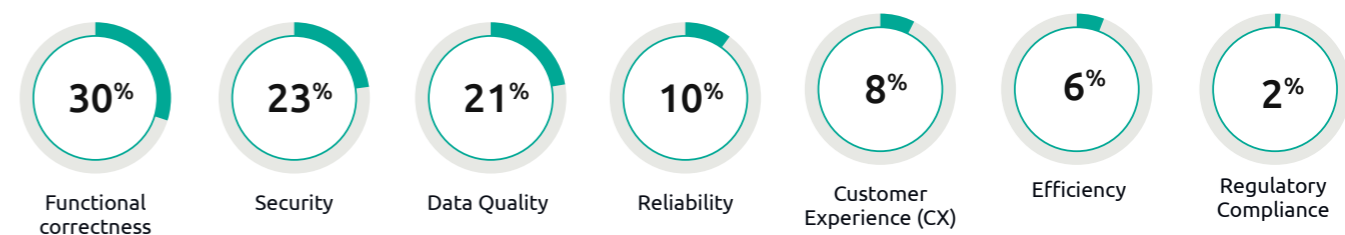
to grow in the future. With the rise of cloud computing, AI, and the demand for more connected user experiences for both customers and employees, the importance of validating these interconnected products will only increase.

## What really matters in intelligent products validation?

Most important aspect in validating an intelligent product

WQR 2024 - Global Results

What aspect is most important to your organization when validating an intelligent product?



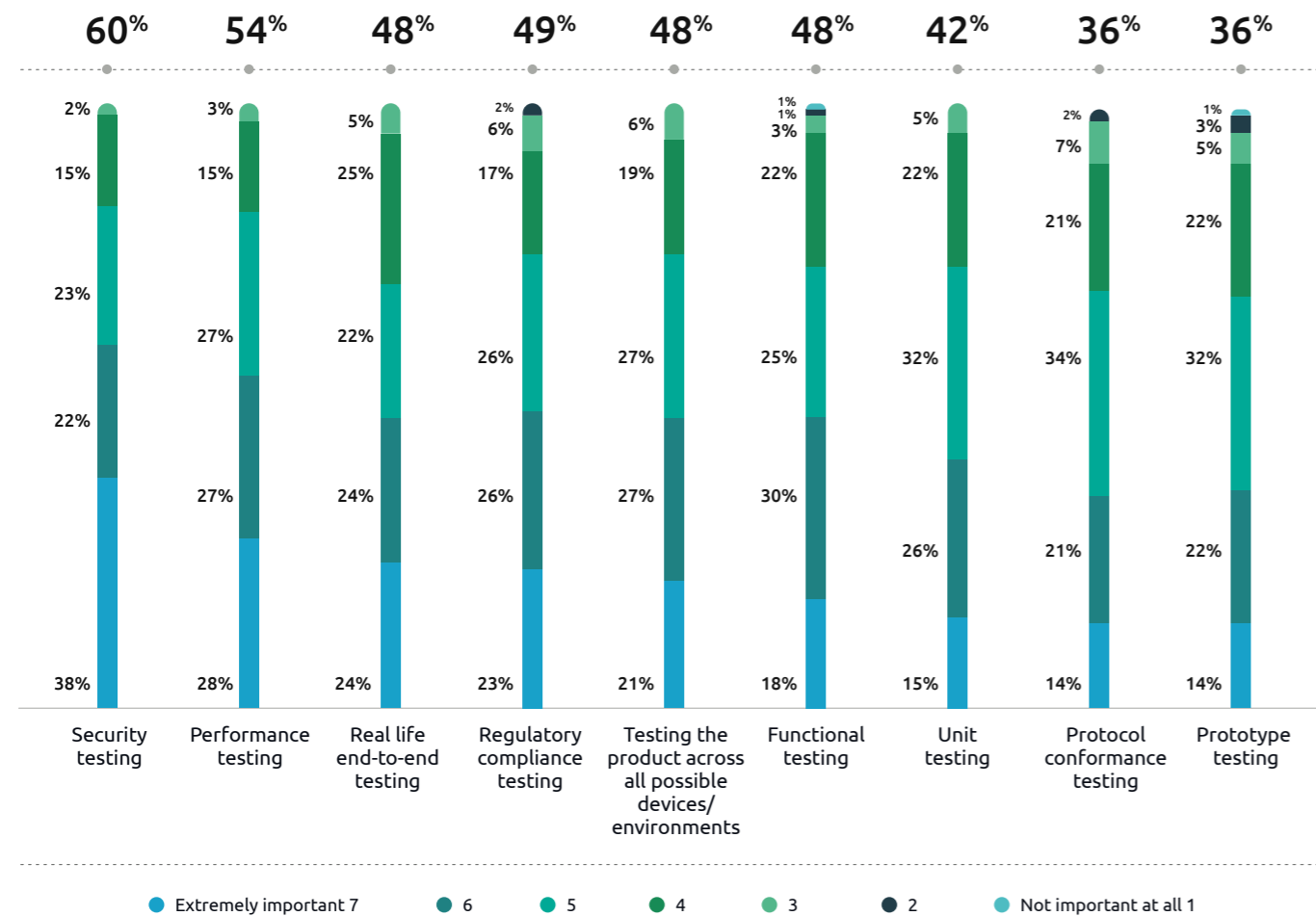
## When it comes to validating intelligent products, certain aspects stand out above the rest:

- 1. Functional correctness (30%):** Ensuring the product performs its intended functions accurately.
- 2. Security (23%):** Critical for maintaining integrity, confidentiality, availability, business continuity, and being compliant.
- 3. Data Quality (21%):** Essential for building contextual and personalized experiences.

This pattern is consistent across all industry sectors with a notable outlier. In the Public Sector, regulatory compliance is considered equally important as security (23%), whereas for regulatory compliance it is only 2%.

**Fig 22 Rating the importance of test phases for testing intelligent products** WQR 2024 - Global Results

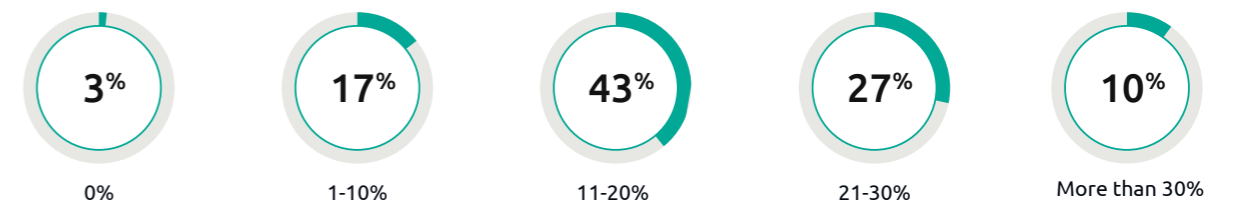
Please rate the level of importance of the following Test Phases when your teams are testing an intelligent product.



When it comes to testing intelligent products, the emphasis on different test phases directly mirrors what respondents consider crucial for validation: functionality, data accuracy, security, and reliability. Interestingly, regulatory, and compliance-related testing highlights its critical role, even though it may not always be directly applicable.

**Fig 23 Testing effort relative to development for intelligent products** WQR 2024 - Global Results

What is the amount of effort relative to development effort, spent for testing an intelligent product?



Average: 21%

On a global scale, organizations typically allocate around 21% of their development efforts to testing intelligent products. About 43% of companies invest between 11% and 20% of effort relative to their development resources in testing, while a quarter dedicate between 21% and 30%. These figures vary significantly across different industry sectors.

## Tackling the toughest testing of intelligent products - head-on!

**Fig 24 Top 3 challenges in testing intelligent products efficiently** WQR 2024 - Global Results

What are the top 3 challenges to testing intelligent products efficiently?



## Testing intelligent products comes with its own set of hurdles. Here are the top three challenges organizations must navigate:

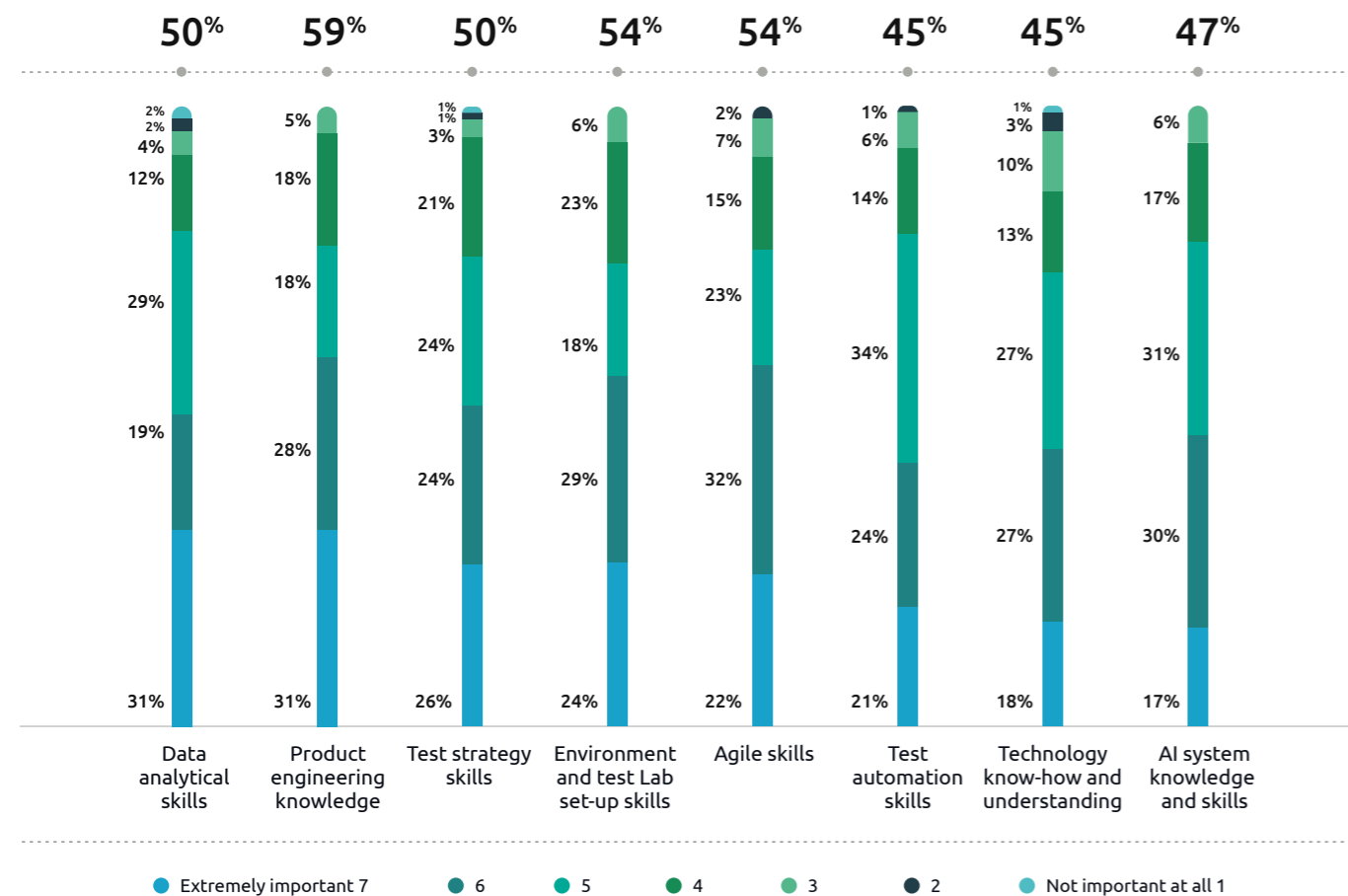
1. Ability to test all embedded AI models and other protocols (53%)
2. Ability to decide the optimal test coverage (i.e., not too much and not too little test) (49%)
3. Ability to sufficiently test all integrations (44%)

Interestingly, organizations are starting to rely more and more on AI models to utilize the vast amounts of data that they collect directly, or through integrations, to provide hyper-personalized user experiences. However, based on the answers, it seems that organizations are finding it hard to adapt to these new demands. Gen AI shows promise in addressing these complexities, a topic we have explored in other sections of this report.

## Top skills for intelligent product test engineers: Meeting today's demands

**Fig 25** Importance of engineer skillsets in testing intelligent products WQR 2024 - Global Results

When testing intelligent products, how important is it that your engineers have the following skillsets?



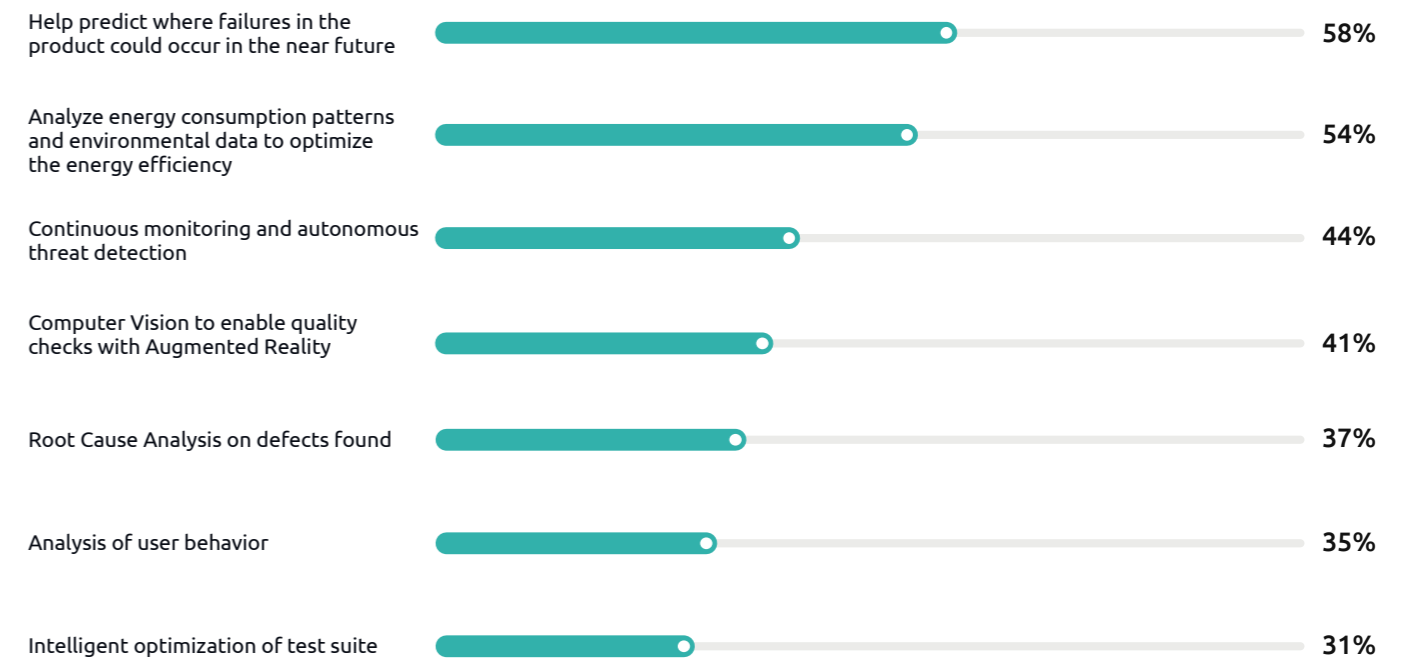
Finding skilled product testers remains a challenge for 44% of organizations. The most sought-after skills include prior product testing experience, the ability to strategize optimal tests, and strong data analytical capabilities. These skills directly address the major challenges organizations face—validating embedded AI, optimizing test coverage, and testing integrations effectively.

While closing the talent gap is crucial, the fast pace of technological innovation and evolving ecosystems means that having skilled talent alone is not enough. Organizations must also learn to utilize some of the emerging technologies (like Gen AI) to tackle the top challenges in intelligent product validation and adapt newer test strategies to be more efficient.

## Leveraging AI's full potential in quality validation of intelligent products

**Fig 26** Top 3 areas where AI can add most value in quality validation of intelligent products WQR 2024 - Global Results

Rank the top 3 areas where AI can add most value in quality validation of intelligent products?



AI has already had a significant impact on intelligent product validation. When asked where AI can help in intelligent product validation, these key areas came out on top.

- **Defect or failure prediction:** Identified by 58% of respondents as the top area where AI can add value in product validation.
- **Data pattern analysis for energy efficiency:** Highlighted by 54% of respondents as crucial for optimizing energy usage.
- **Continuous monitoring and autonomous threat detection:** Recognized by 44% of respondents for enhancing product security.

Interestingly, test case prioritization, test case selection, and root cause analysis saw reduced priority in comparison with last year's survey. This shift reflects a growing emphasis on sustainability, reliability, and security in product evaluation. Areas where AI can contribute most to intelligent product evaluation will evolve further in the future, and we'll be watching this space closely.

## Our key recommendations

- **Invest in AI:** Optimize testing by leveraging AI to ensure intelligent products are tested accurately and efficiently.
- **Upskill quality engineers:** Bridge the skill and talent gap by preparing product quality engineers for evolving technologies.
- **Integrate Gen AI:** Employ Gen AI to create a blend of “digital testers,” enhancing efficiency to match the increasing development velocity.
- **Revise test strategy:** Adapt existing strategies to incorporate human testers for validating product quality aspects that AI and Gen AI cannot address, such as usability, bias, and exploratory testing.

## Focus on the new future

As we wrap up our deep dive into intelligent product validation, we can agree on the fact that achieving exceptional product quality and building unforgettable user experiences require careful thought and continuous evolution. Bridging the talent gap and leveraging AI for defect prediction, energy efficiency,

and threat detection are key to overcoming validation challenges.

A strategic, holistic quality approach will help organizations navigate the complexities of the connected world, securing a competitive edge and fostering lasting customer loyalty.



## Client Perspectives - Liberty Latin America

*At Liberty Latin America (LLA), we have transformed our approach from a reactive stance to executing structured processes, implementing automation, and integrating Continuous Integration (CI)/Continuous Deployment (CD). Now we are focused on embedding integrated testing and cutting-edge technologies like Gen AI throughout the Software Development Life Cycle (SDLC).*

*One of the significant challenges we've faced in the telecom industry is the complexity of automation. We started with component-based regression automation and are now striving for higher maturity levels. To address this, we're in the process of establishing a dedicated automation center of excellence. This center will focus on several key areas: Test automation for CRM and Call Detail Records (CDRs), business process automation using Robotic Process Automation (RPA) to streamline back-end processes, and service assurance automation to enhance end-to-end service monitoring in production environments. We feel that by integrating AI across these verticals, we can maximize the benefits and address emerging challenges.*

*Our AI projects are already making an impact, particularly in areas like requirement analysis, design documentation, and operational initiatives such as triaging trouble tickets and summarizing alarms. As we continue to navigate the complexities of performance and security testing, especially with our new cloud-based stack in Puerto Rico, we are committed to refining our performance testing practices. This includes setting up robust frameworks, tooling, and benchmarks to ensure optimal results.*

*Security and compliance automation within the SDLC are also crucial aspects of our strategy. We recommend embedding security policies and procedures into the project lifecycle to proactively address potential threats rather than reacting post-incident. Our goal is to build a comprehensive automation center of excellence that spans test automation, business process automation, and service assurance automation. Integrating AI into these processes will help us overcome challenges in performance testing and address global skill set issues.*

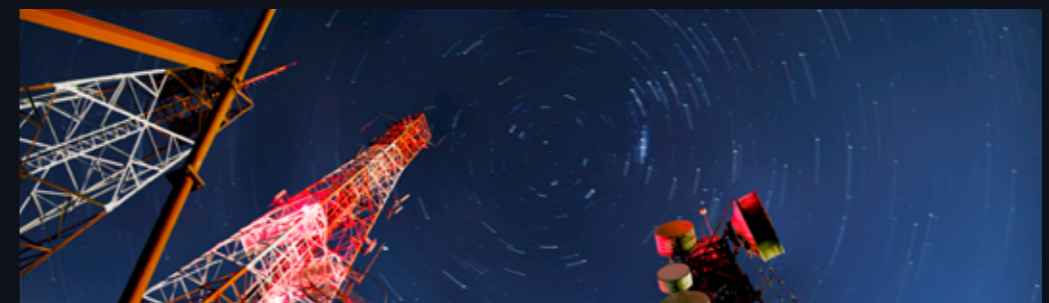
*Recently, efforts have been focused on preventing organizational crisis and being deeply embedded in compliance and policy formation. Quality plays a significant role in supporting sustainability by collaborating with compliance and revenue assurance. This collaboration can help prevent several crises and support sustainability efforts, contributing to the overall betterment of business practices.*

*Our AI initiatives are revolutionizing various aspects of our operations, from requirement analysis and design documentation to deployment procedures and test script creation. Tools like Atlassian Intelligence are enhancing our root cause analysis and troubleshooting capabilities, significantly improving our overall efficiency and effectiveness.*

*Through these advancements, we believe our AI projects are already showing promising results, improving the accuracy and efficiency of our processes. By embracing innovative solutions, we ensure that we stay at the forefront of Quality Engineering advancements and industry developments.*

### Shikha Handa

Sr. Director, IT Service Management, LLA



# Quality Engineering in Sustainability

## Dinesh Batra

Group Vice President, Data & AI, Sustainability, Capgemini Americas

## Jeba Abraham

Practice Vice President, Quality Engineering & Testing, Sogeti USA

## Nilesh Yeola

Senior Director, Capability Unit Leader, Quality Engineering & Testing, Financial Services, Capgemini India

## Lisha Rakesh

Senior Director, Financial Services, Capgemini India

## Shalini Rajeev

Program Manager, Global Sustainability CoE, Capgemini India

## Sustainability in action: How can Quality Engineering help build a greener tomorrow?

Today, sustainability isn't just a nice-to-have; it's a must-have for our planet's survival. We're shifting gears from simply cutting our carbon footprint to smartly managing resources, ensuring our ecosystems, communities, and economies can flourish. As the signs of climate change and resource depletion become impossible to ignore, the need for sustainable practices is more urgent than ever.

Organizations across various sectors are making significant sustainability commitments, driven by voluntary initiatives and regulatory mandates. These commitments encompass reducing carbon footprints, minimizing waste, and promoting social equity and ethical governance. By integrating sustainable practices into their core operations, organizations not only contribute to preserving our environment but also enhance their social profile and long-term viability, ensuring a better world for future generations.

In this year's World Quality Report, we take a comprehensive look at sustainability and explore Quality Engineering's pivotal role in driving sustainable practices across organizations.

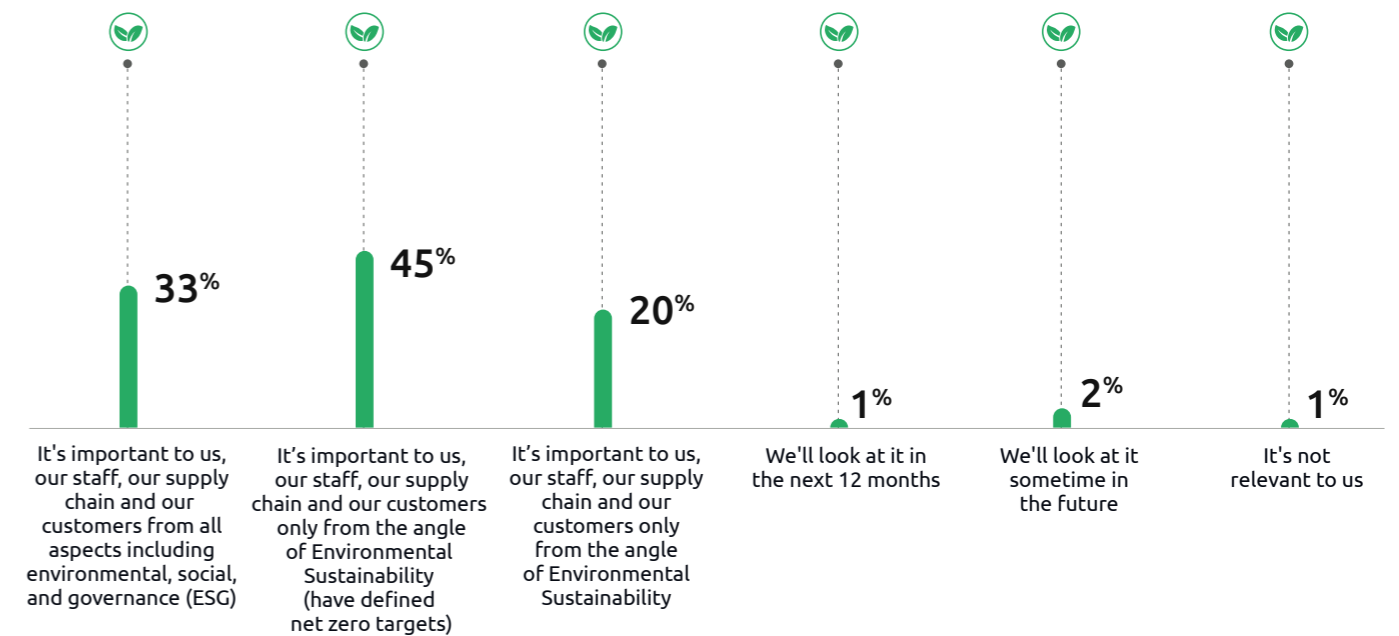
## What's in focus when sustainability is a priority?

Fig 27

Prioritization of sustainability in the organization

WQR 2024 - Global Results

Is sustainability a primary agenda of your organization?



It is evident that sustainability is a top priority for every organization today. And here's proof—a whopping total of 98% of organizations acknowledge that sustainability is extremely crucial to them! But what does that mean in practice? When we dig a little deeper, we find that about one-third of these organizations are dedicated to every aspect of sustainability. This means they're not just talking the talk, they're walking the walk in environmental, social, and economic dimensions.

However, this focus is not uniform. Around 45% of organizations are primarily focused on reducing their environmental impact, with committed net zero targets driving their efforts. Additionally, 20% of organizations are environmentally conscious but have not yet set net-zero targets.

So, while the commitment to sustainability is almost universal, the strategies and specific goals can vary widely.



## Let's talk Green IT!

**Fig 28 Green IT principles aligned with ESG documentation and measurement** WQR 2024 - Global Results

Is the focus on Green IT Principles translated to documenting and measuring environmental, social, and governance (ESG) parameters as key performance indicators?



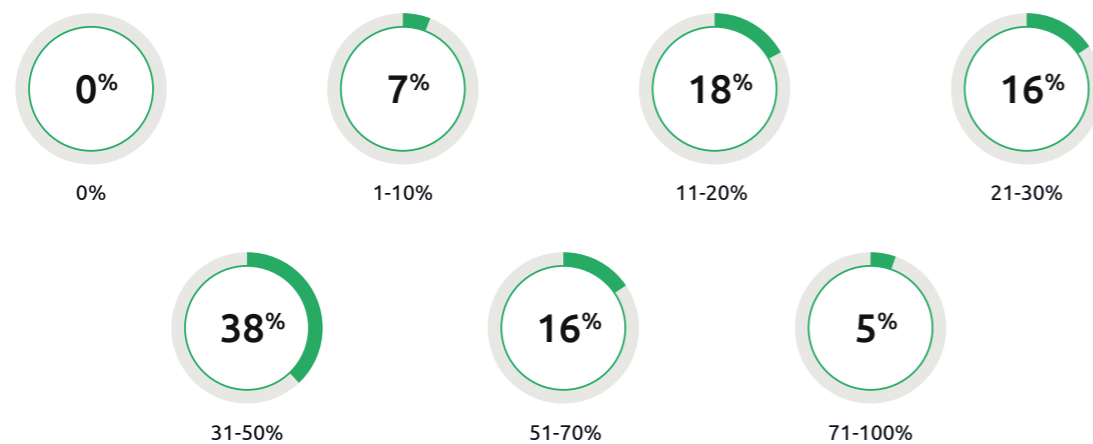
When it comes to Green IT, we found that 44% of organizations have Green IT KPIs defined and are actively tracking them. This shows a strong commitment to integrating sustainable IT practices. Meanwhile, 39% of organizations have made some efforts in this area, but their initiatives are more scattered and less structured. The rest of the organizations are planning to incorporate Green IT principles in the future.

It's encouraging to witness that no organization dismisses the relevance of Green IT. However, there's still plenty of room for improvement, particularly in the areas of defining and tracking Green IT KPIs effectively. These metrics are crucial in achieving sustainability targets across most organizations and making a real impact. So, while the commitment is evident, refining these processes will be key in driving meaningful progress.

## All about sustainability: The key to unlocking futures

**Fig 29 Degree of sustainability training and awareness in IT organization** WQR 2024 - Global Results

What percentage (%) of your IT organization has been trained and/or has some awareness on the subject of sustainability to drive various sustainability initiatives?



Average: 37%

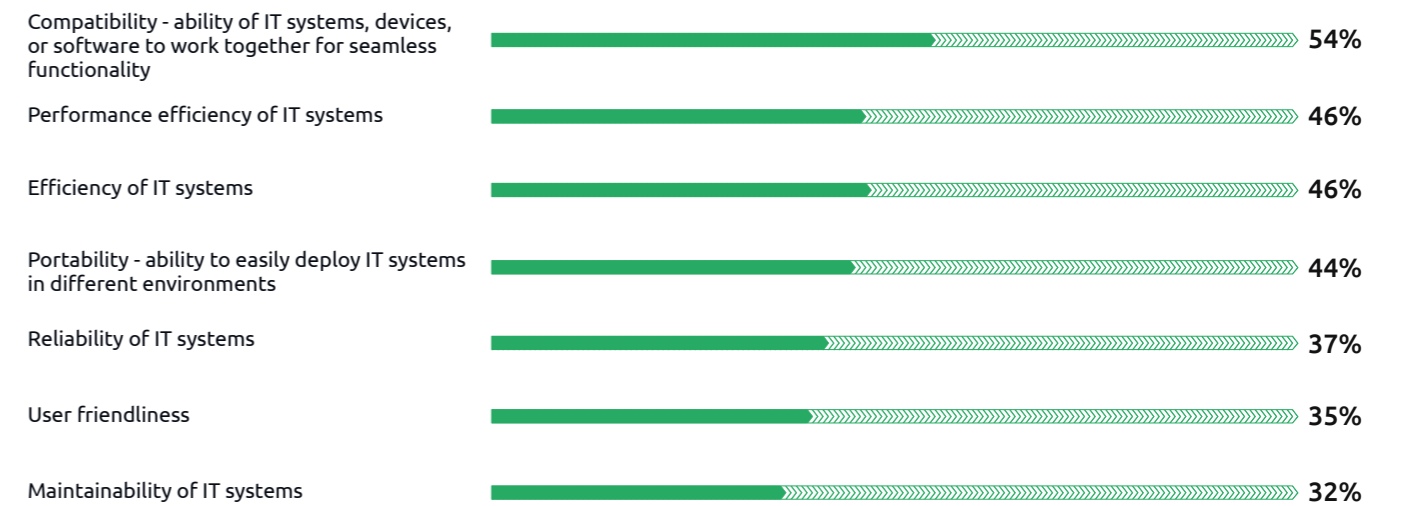
It is alarming to see that almost 80% of organizations have less than half of their IT staff aware of sustainability issues. Raising awareness is the first essential step, but it doesn't stop there. Organizations must invest in educating their IT teams

on sustainability and Green IT practices. Clear and measurable KPIs are crucial for success on the journey to a greener, more sustainable future.

## What are the driving factors of Green IT initiatives?

**Fig 30 Top 3 focus areas for teams to validate Green IT principle** WQR 2024 - Global Results

What are the three most important focus areas your teams validate or should validate to drive Green IT principles?



Don't know/Not Relevant to us: 2%

Managing Green IT principles can become more difficult with the continuing increased adoption of cloud environments from hyperscalers and Software-as-a-Service (SaaS) solutions from third parties. Are you then still in control of the performance efficiency, energy efficiency, and other Green IT principles?

To drive Green IT initiatives effectively, even when organizations use more third-party cloud and SaaS solutions, it's crucial that organizations establish their own clear priorities, well-defined Green IT KPIs and ensure that teams are well-equipped to drive them.





## Where is Quality Engineering contributing the most in driving the sustainability agenda?

**Fig 31** Improvements in Quality Engineering & Testing processes for sustainability WQR 2024 - Global Results

What kind of improvement have you brought in your Quality Engineering & Testing processes to be more sustainable?



The data reveals that Quality Engineering is at the forefront of social sustainability, with 58% of organizations prioritizing their efforts here—an encouraging sign! However, we expected to see higher numbers for organizations implementing efficient Quality Engineering practices (34%), especially with the rise of Agile and DevOps practices and the push for more test automation. Clearly, the numbers indicate that there's still plenty of work to be done.

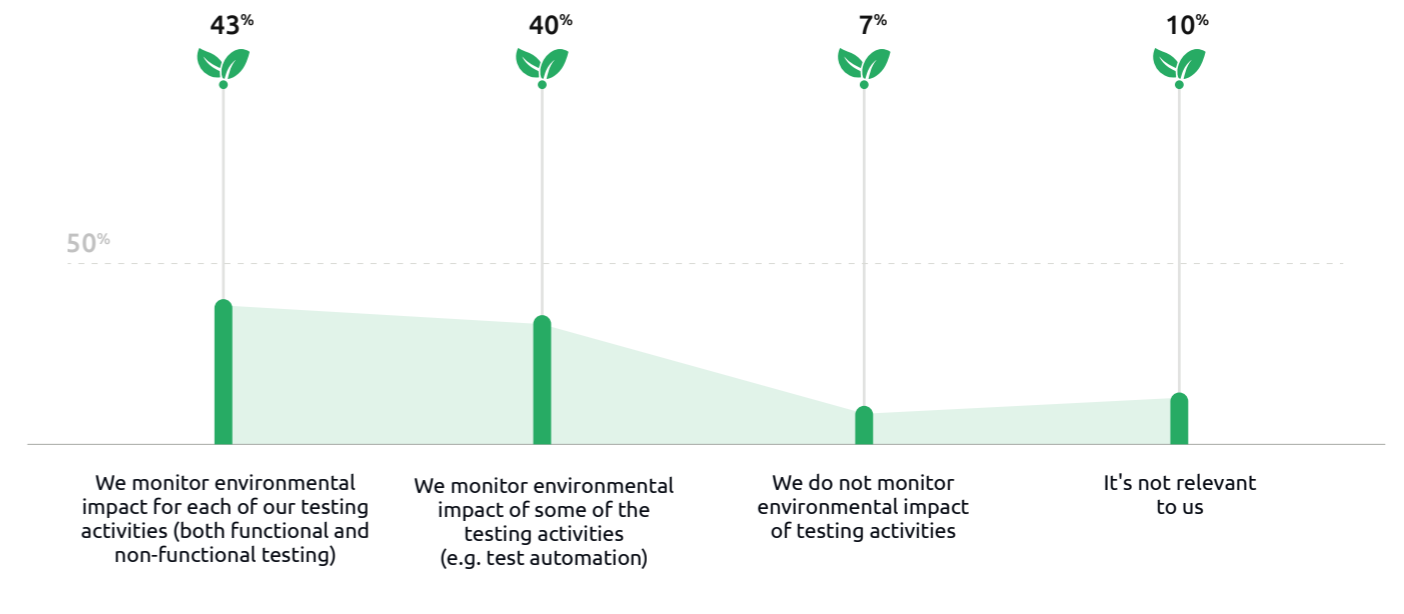
It's also concerning that only a quarter of organizations are currently measuring the environmental impact of their IT development. While 44% of organizations have defined Green IT KPIs, there's a significant need to improve environmental impact measurement. As the saying goes, "You cannot control what you cannot measure." This presents a clear opportunity to strengthen and expand Quality Engineering's role in supporting the measurement and success of both social and environmental sustainability initiatives.



## Are we truly measuring the environmental impact of Quality Engineering?

**Fig 32** Measuring environmental impact in Quality Engineering activities WQR 2024 - Global Results

Has a measurement process been established to monitor environmental impact (e.g. CO2 emissions) resulting from Quality Engineering activities in IT?



Here's an interesting observation: About 43% of organizations measure the environmental impact of their testing activities, but only 25% do so for overall IT development. This discrepancy suggests that many organizations are measuring the environmental impact of some parts of the Software Development Lifecycle (SDLC), like testing, rather than the entire Software Supply Chain.

For organizations with a sustainability-first mindset of advancing the Green IT agenda, it's crucial to move beyond fragmented approaches. To make a real impact, organizations must adopt a more comprehensive approach to measuring the environmental impact of the entire SDLC, not just isolated parts. A unified strategy is essential for tracking progress and achieving comprehensive sustainability goals.

### Our key recommendations

- **Define and track Green IT KPIs:** Establish clear and effective Green IT KPIs and track them diligently.
- **Measure environmental impact:** Develop comprehensive processes for measuring the environmental impact of all Quality Engineering activities, not just isolated parts.
- **Focus on key areas:** Prioritize validating compatibility of IT systems, and clearly identify and focus on the top areas for driving Green IT principles.
- **Practice sustainable testing:** Integrate sustainability into testing activities to advance organizational sustainability goals.
- **Increase awareness and training:** Invest in raising awareness and providing training on sustainability and Green IT practices across all IT staff.

## What the future holds?

Quality Engineering plays a crucial role in driving the sustainability agenda of organizations. By prioritizing environmental and social impacts, defining clear KPIs, and investing in education and skilled teams, companies can make significant strides towards a greener future. Quality Engineering is a key enabler of that future, ensuring sustainable practices are embedded throughout the product and software lifecycle.

Moreover, by effectively utilizing Quality Engineering to drive the Green IT agenda, organizations can optimize resource efficiency, minimize waste, and enhance durability and efficiency. With a strategic and thorough approach, Quality Engineering will remain essential in shaping a sustainable future.



## Client Perspectives - AXA

*At AXA, we recognize that automation and synthetic data generation are pivotal for boosting productivity and efficiency. Our evolving experiences have sharpened our insight into customer needs and user experiences. As the testing landscape has advanced, we feel it is essential to adopt a more technical and integrated approach to address these new demands effectively.*

*Our primary challenge has been managing the diverse nature of our testing tasks—whether it's accessibility, mobile testing, or performance. Each area demands unique expertise, making it crucial to maintain a cohesive strategy across various domains. Historically, we tried separating automation teams from functional testing teams, but this led to a disconnect. We've since integrated automation into every team, promoting it as a fundamental skill for all testers. This integration fosters a unified approach, ensuring that when challenges arise, our team can build on collective knowledge and feedback.*

*With the advent of Gen AI, we see both exciting opportunities and new challenges. We feel that while AI can automate more complex tasks and enhance efficiency and quality, it is vital to ensure that AI-generated outputs undergo rigorous human validation. Balancing AI's capabilities with essential human review is key to maintaining quality and ethical standards.*

*Ethics is a cornerstone of our approach, especially concerning data privacy, security, and environmental impact. We are committed to responsible data use and compliance with regulations. Addressing biases in AI models and ensuring transparency in AI-driven decisions are vital aspects of our ethical framework. Our environmental goals include sustainable practices, such as cloudification and the decommissioning of outdated systems.*

*Adaptability and continuous learning are at the heart of how we manage technological complexity and rapid evolution. Our recruitment strategy focuses on hiring individuals who can quickly learn and adapt, rather than those with specific expertise. This approach helps us stay current with technological advancements and maintain our effectiveness. We foster a culture of empathy, curiosity, and collaboration, which supports our team in tackling challenges and driving innovation.*

*One of our key initiatives is developing a sustainable testing environment. We recommend strategies like microservices and on-demand environment creation to optimize resource management. Our commitment to green IT involves eliminating outdated systems and promoting shared responsibility in the quality process.*

*In terms of Gen AI, we have undertaken several innovative initiatives. For example, we've developed an AI tool to evaluate the completeness and quality of user stories before development. This tool helps product owners and business analysts by analyzing and improving user stories, which are then validated through our "3 Amigos" sessions. We've also integrated AI into our "3 Amigos" practice to generate questions and refine specifications, enhancing the quality of user stories and overall project outcomes.*

*Looking ahead, our priorities include refining our testing methodologies, embracing advanced technologies like AI, and maintaining our high standards of quality and security. We aim to cultivate a strong sense of pride and expertise within our team, ensuring that everyone is motivated and valued. As we continue to adapt to the ever-changing technological landscape, we remain steadfast in our commitment to quality and ethical responsibility.*

### Lionel Brat

Head of Test, AXA (France)

## Client Perspectives - Leading Intimates Specialty Retailer



*Quality is paramount in every industry, and the evolution of testing from being a 'nice-to-have' to becoming a crucial component of the SDLC lifecycle is evident. At the Leading Intimates Specialty Retailer, our testing teams play a pivotal role in not only ensuring quality but also in providing business assurance and at the forefront is Capgemini's testing teams, helping businesses elevate their productivity and improve business process designs.*

*It's fascinating to see how technologies like AI and GPT models have evolved today. While AI has been around for decades, the ability to train on diverse datasets has only recently made it practical for business applications. However, it's important for businesses to define their specific challenges and use cases before adopting AI. Simple applications like chatbots can provide significant value by automating processes and building intelligence tailored to the specific needs of the business.*

*Another critical aspect in the fashion industry is - personalized experiences. Consumers are increasingly seeking personalized connected experiences, and it's essential for businesses to meet these expectations by leveraging technology and ensuring that these experiences are meaningful for both the business and the end customer.*

*We feel, the key challenge organizations face with rapid technological advancements today, is the blurring line between business and technology. As technology becomes integral to business processes, distinguishing between business goals and technological solutions becomes difficult. For instance, achieving sustainability requires not only technological innovations but also a shift in business practices.*

*Looking ahead, we can expect a convergence where business and technology are seamlessly integrated. Organizations need to adapt by fostering collaboration between IT and business teams to continuously add value and address challenges effectively.*

Associate Vice President, IT, Leading Intimates Specialty Retailer

# Data Quality

## Andrew Fullen

Head of Innovation and Technology, Sogeti UK

## Okan Baysan

Senior Test Manager, Quality Engineering & Testing, Sogeti UK

## Nitin Kutre

Transformation Lead, Quality Engineering & Testing, Financial Services, Capgemini India

## Navigating the data deluge: Why quality matters now, more than ever!

Data has always been at the heart of business decisions. The quality of data, therefore, has an immense impact on business results, and even more so for digital-driven organizations. Additionally, the quality of data directly impacts the efficiency of business processes and IT development processes, and with the integration of Gen AI, data is now of even greater importance.

With the dramatic rise of Gen AI-based systems, the demand for excellent quality, bias-free, and reliable data has become more critical than ever. Gen AI systems thrive on vast amounts of high-quality data; poor data can become embedded in new systems, tools, and ways of working, leading to significant risks.

In this year's report, we focus on the lenses from which we view "Data Quality" to also include its impact on the usage of Gen AI-based solutions. We expected an increased focus on data to be reflected in our World Quality Report, with organizations placing greater emphasis on its importance; however, what we found was quite surprising!

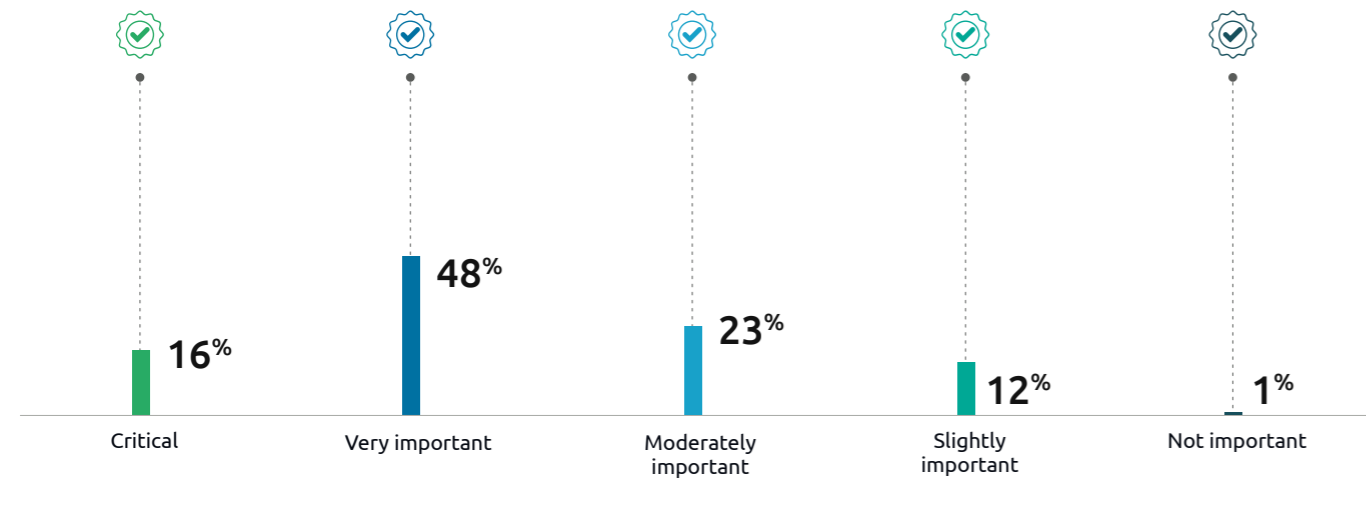


## Assessing data's impact: The current landscape

Fig 33 Importance of data quality

WQR 2024 - Global Results

How important is data quality to your organization?



This year's survey results indicate that 16% of organizations consider data critical, while 48% see it as very important. Interestingly, only 1% do not regard it as important at all. This means that 64% of organizations acknowledge the significance of data, but a total of 36% still do not prioritize it as they should. These findings are unexpected, especially given the severe

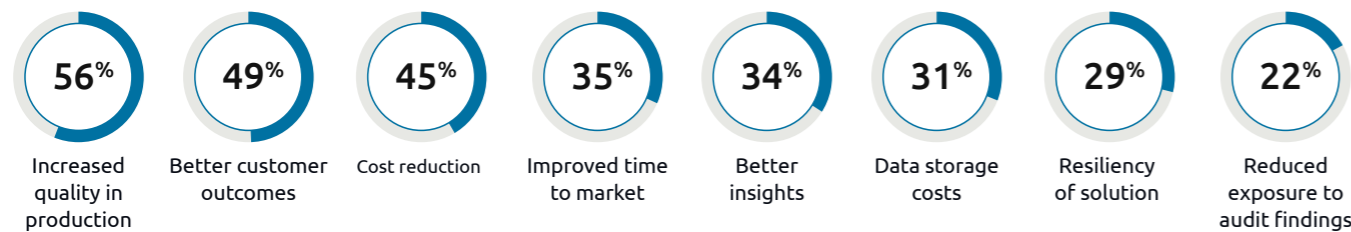
consequences of data breaches and the fundamental role data plays in organizational operations and AI systems. The lack of prioritization raises concerns about these organizations' operational efficiency, decision-making, compliance, and potential reputational damage.

## What is the value of data?

Fig 34 Top 3 areas of ROI in data management

WQR 2024 - Global Results

What are the top 3 areas of return on investment in data management?



Organizations have identified the top three areas of return on investment from data management:

- **Increased production quality (56%)** - Improved data management enhances production quality, reducing errors and boosting efficiency in business operations.
- **Better customer outcomes (49%)** - High-quality data leads to more personalized and effective customer interactions, increasing satisfaction and loyalty.
- **Cost reduction (45%)** - Effective data management reduces operational costs by reducing inefficiencies and errors.

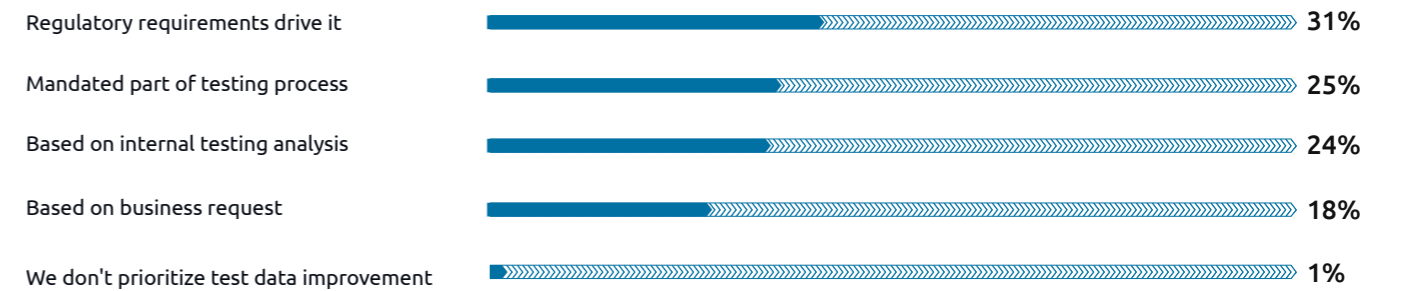
Despite a third of organizations not viewing data as crucial, its value in enhancing customer satisfaction and reducing costs is evident.

## Optimizing resources: Strategic data improvement

Fig 35 Prioritization and resource allocation for test data improvement

WQR 2024 - Global Results

How does your organization prioritize and allocate resources for test data improvement?



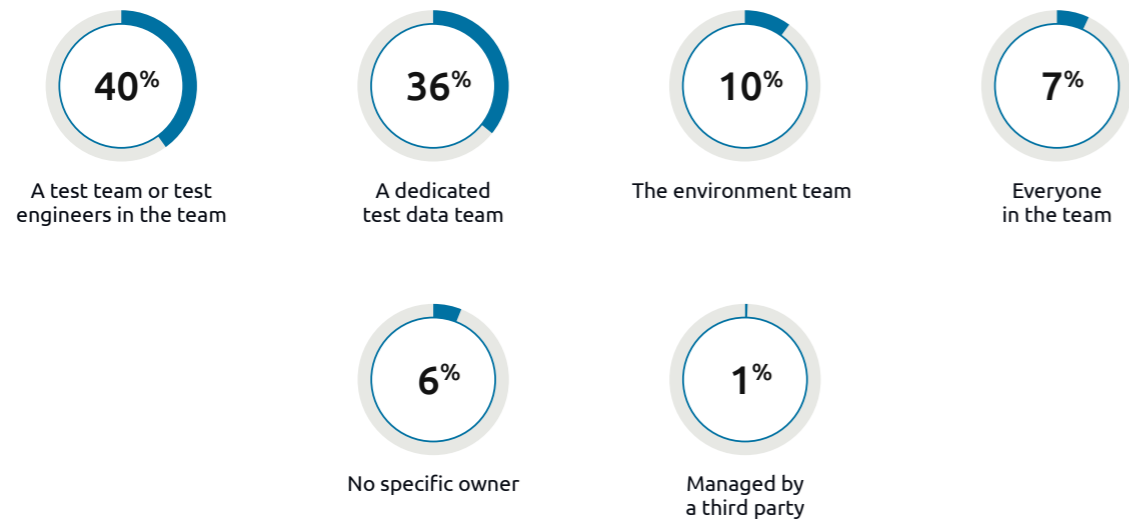
Most organizations focus on data improvements to meet legal and regulatory requirements (31%), and the impact of these regulations varies significantly by region. However, this compliance-driven approach tends to be reactive, often leading to scattered efforts and missed opportunities. The uneven allocation of resources and inconsistent standards point to the need for a more comprehensive and strategic approach to data management.

## Test data: Who holds the reins?

Fig 36 Responsibility for test data provisioning

WQR 2024 - Global Results

Who owns test data provisioning?

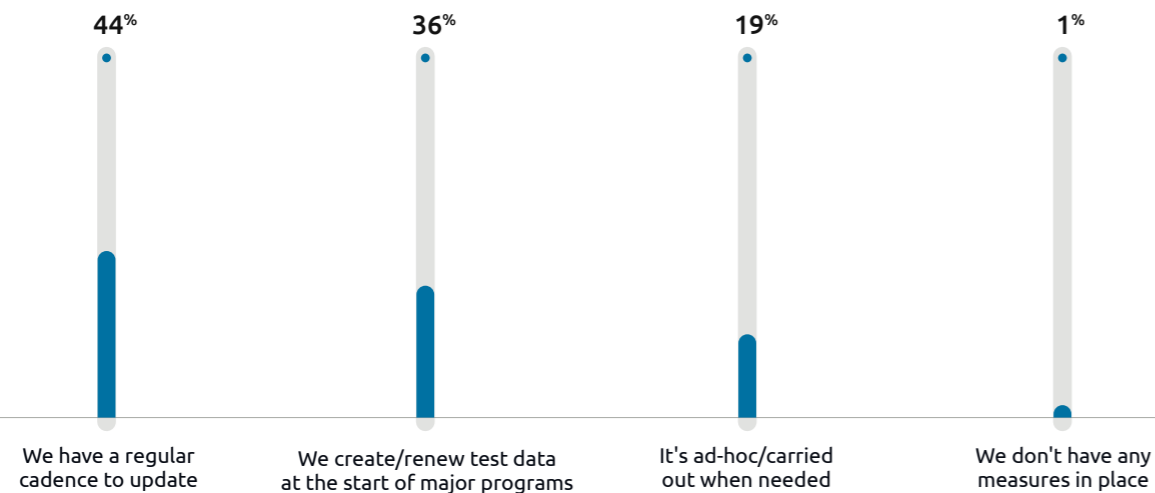


Within the Quality Engineering & Testing activities, the availability and quality of test data have always been a major challenge across all our surveys. In this year's survey, we noticed that test data provisioning is usually managed by test teams (40%).

Fig 37 Measurements to keep test data up to date

WQR 2024 - Global Results

What measures to do you have to keep test data up to date?



Many organizations recognize the importance of regularly updating or refreshing their test data (44%). However, there is a concerning trend—the continued use of unmasked production data, which puts them at risk of regulatory non-compliance.

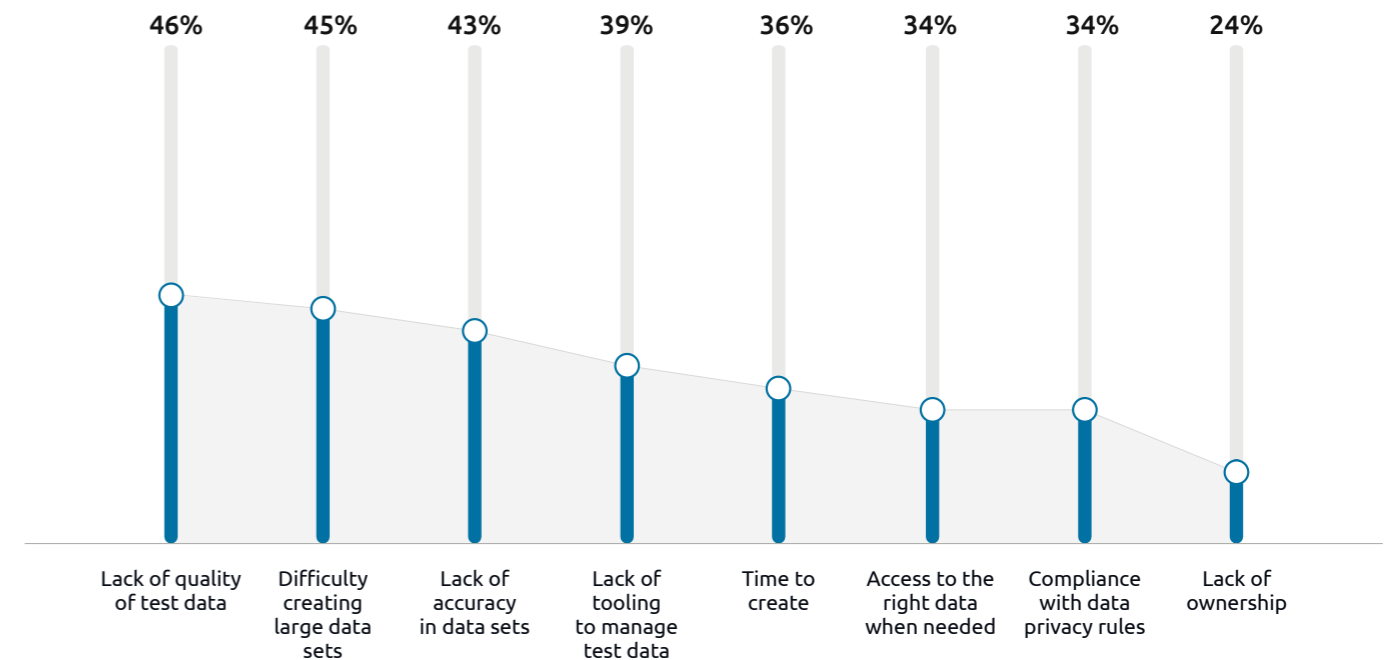
Without systematic data refresh measures, organizations face testing inaccuracies, potential system failures, security vulnerabilities, and higher costs. This highlights the urgent need for better data management practices.

## Challenges in creating test data

Fig 38 Top 3 test data pain points

WQR 2024 - Global Results

What are the top three pain points your organization experiences with test data?



Creating test data presents several challenges, which include:

- **Lack of quality of test data (46%):** Despite using synthetic data and pre-existing libraries, nearly half of the respondents struggle with data quality, indicating the need for better implementation and standards.
- **Difficulty creating large data sets (45%):** Generating large datasets is essential, but challenging due to inadequate tooling and resource constraints, impacting comprehensive testing.
- **Lack of accuracy in data sets (43%):** Accurate data is critical for reliable testing. However, synthetic and pre-existing data often fall short, leading to potential testing inaccuracies.
- **Lack of tooling to manage test data (39%):** Effective test data management is hindered by a lack of advanced tools, affecting the ability to generate, manipulate, and use test data efficiently.

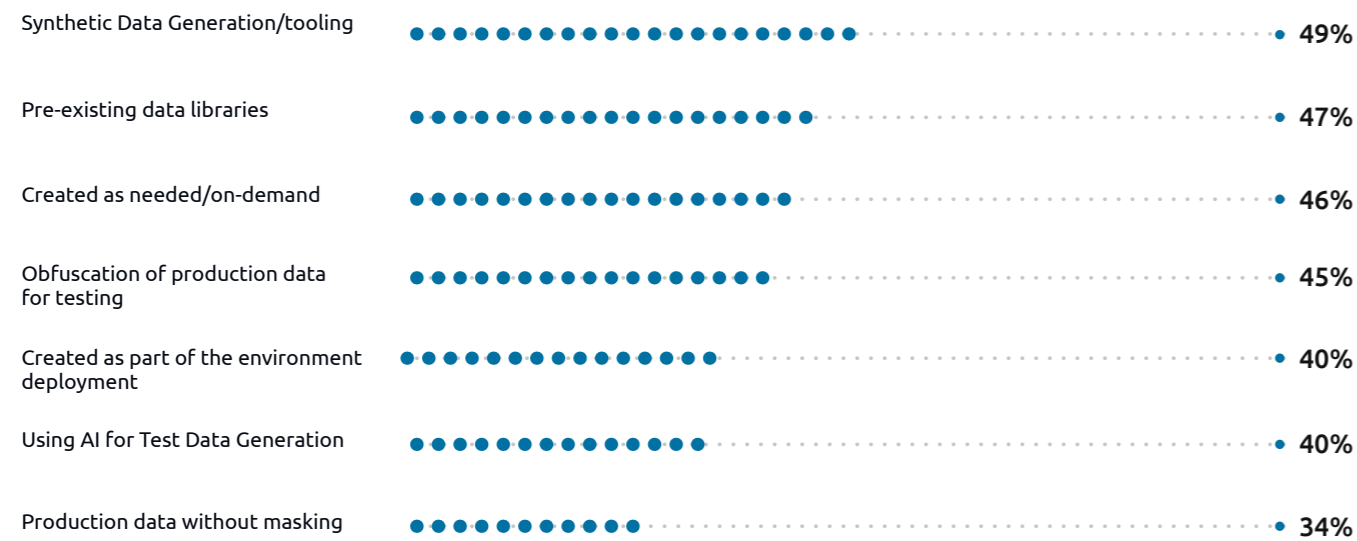
These challenges hinder effective testing and are exacerbated by the industry's reluctance to invest in test data governance policies and test data management teams. There is a critical need for improved test data management practices and the adoption of advanced technologies to overcome these hurdles.

## AI and test data provisioning made possible

Fig 39 Approaches to test data provisioning

WQR 2024 - Global Results

How are you provisioning your test data?



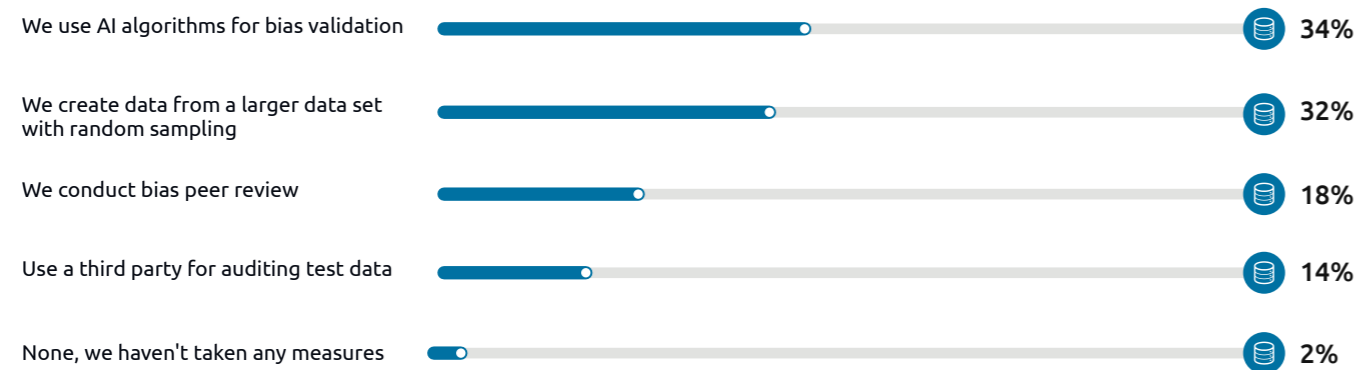
More organizations are turning to AI-generated test data (49%), but this comes with its own set of ethical, security, and compliance issues. Discouragingly, 34% responded that they still rely on unmasked production data, which carries legal and operational risks. While synthetic data generation tools are gaining traction (49%), it is crucial to maintain data integrity and ensure compliance.

## Ensuring bias-free test data

Fig 40 Strategies for bias free test data

WQR 2024 - Global Results

What measures have you taken to ensure your test data is bias free?



Almost a third of organizations rely on AI to check data quality and remove biases (34%), but this approach often lacks transparency and context, which can unintentionally reinforce existing biases. Another third use case, random sampling from larger datasets,

can result in biased and insufficient variability. It is essential to address these issues to maintain data integrity, develop reliable AI systems, and navigate the complex ethical and legal landscape.

### Our key recommendations

- **Clear ownership:** Establish clear ownership and responsibility for management and quality of all relevant data across the organization. This includes business-related data, as well as your critical technical support data (which includes relevant test data).
- **Invest in quality data:** Invest in obtaining the best quality, bias-free data through AI tools to support better customer outcomes, and informed decision-making.
- **Embrace legal frameworks:** Fully embrace General Data Protection Regulation (GDPR) and similar legal frameworks to ensure compliance and protect data integrity.
- **Recognize data's value:** Many organizations fail to appreciate the critical role data plays in their smooth operation. This mindset must change for better efficiency and decision-making.

## Shaping what's next

There is a lot of work to be done for many organizations when it comes to handling their data, be it production, testing, or data to train AI systems. The costs of storage for unnecessary data are high, but a lot of organizations will need to decide if the cost of storage is less than the cost of having the wrong data!

There is no denying that data is critical to all organizations and IT systems. What we found was that, despite a lot of conversations and promises about its importance, many organizations continue to undervalue data and underestimate the risks of not having the best, bias-free data in the quantities needed to test and train new systems.

For over 15 years, we have been asking questions about data and its importance in the World Quality Report. Each year,

organizations talk about focusing more on this, yet the same perceptions persist about the quality and importance of data. Despite the critical role data plays in AI and organizational success, many organizations still do not give it the focus it deserves.

From an ethical standpoint, we as IT professionals must ensure that data is accurate, fair, and as free from bias as possible. Arguments about the costs of tools or the lack of appropriate tools have been ongoing for years. With the demands of AI, compliance requirements for data access, the need for effective testing in cloud environments, and the associated costs, these issues must be managed now.



## Client Perspectives - Specialty Insurance Provider



We believe, Quality Engineering is evolving with the rise of AI and automation. AI has changed the game by automating tasks and enhancing user stories, acceptance criteria, and test scripts. Tools like ChatGPT and Microsoft Copilot are leveraged to fit specific needs, though access to advanced AI tools is controlled to ensure data security.

Rather than formal training, a more decentralized approach is used to improve skills. Teams share knowledge and learn by doing, which is rooted in real-world needs. Quality approach is built into the Agile system where everyone shares responsibility, though a dedicated team remains essential, supported by — partnerships like Capgemini.

Quality engineers need a mix of technical and business skills to ensure the products they test match with the organization's broader goals. As AI tools take on more technical jobs in the future, engineers are expected to spend even more time understanding and meeting business needs.

Challenges with end-to-end testing across a diverse tech landscape are still being worked on, but improvements are being made. Efforts to reduce the data center footprint and use Software-as-a-Service (SaaS) solutions are boosting productivity while also contributing to sustainability.

As we advance, our strategy is to continue refining processes, fostering collaboration, and adding value through smarter AI-driven Quality Engineering, embracing long-term thinking and innovation.

Managing Director - IT, Specialty Insurance Provider

## Client Perspectives - Telia



At Telia, Quality Engineering strikes a balance between automation and the human element, between productivity and creativity. In today's fast-paced environment, teamwork matters more than ever. We join forces with our teams making sure that while automation plays a huge role, we don't automate just because we can. Instead, we focus on lasting automation, finding that ideal mix where hands-on testing still leaves room for fresh ideas and breakthroughs.

Taking care of test data is another key part. We use carefully simulated data to closely mirror production data. This approach safeguards data privacy and maintains the integrity and accuracy of our testing. Additionally, regular cleaning up data and bettering our methods enhances productivity. By streamlining what tests are required, we alleviate extra work and stay focused on what adds value to the business.

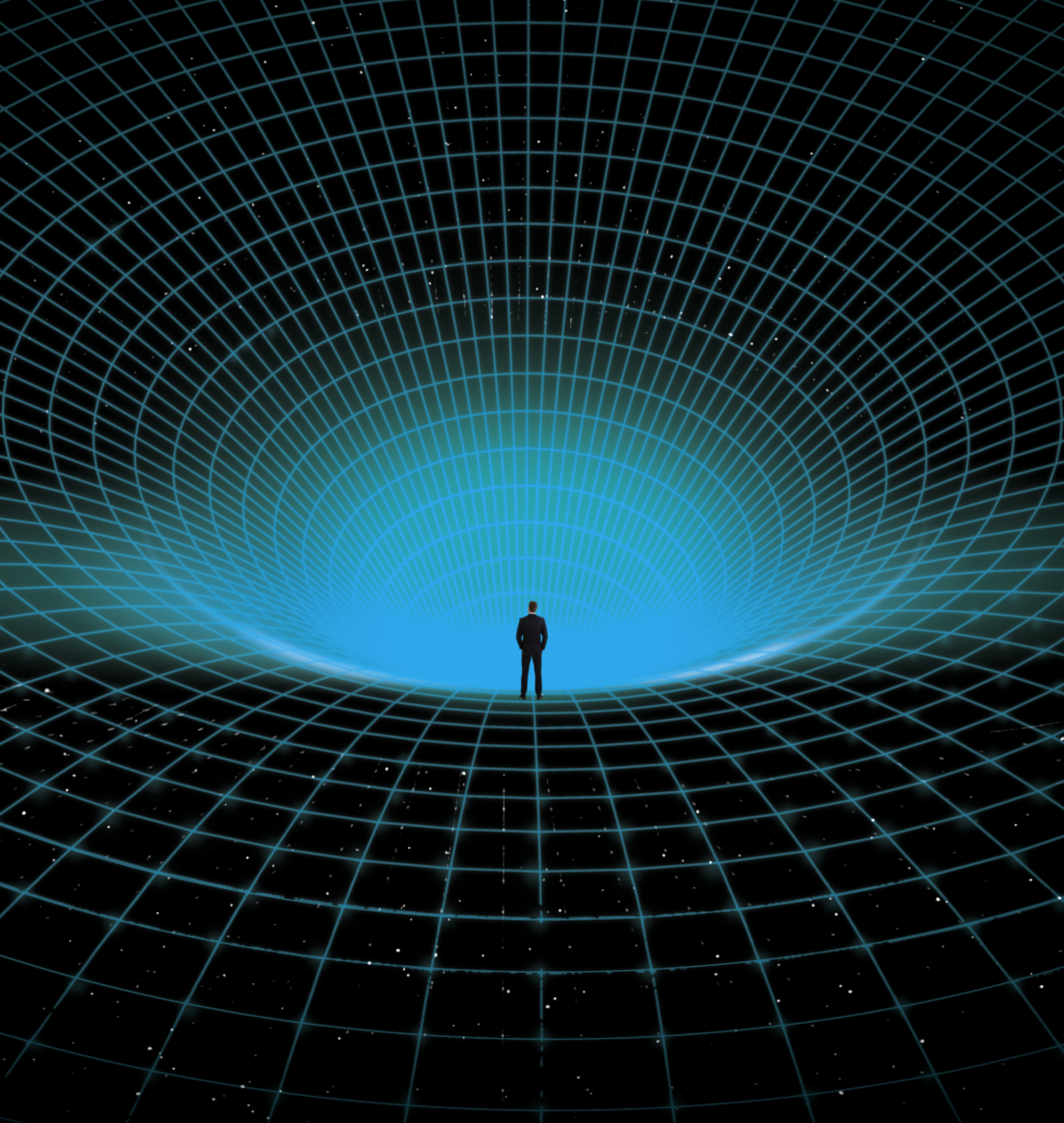
When we talk about big systems and their complexity, we can't just look at how each system works on its own. We need to be on top of things when we're dealing with a setup where lots of systems work together. If we push our teams to understand the whole testing landscape, we can cut down on risks, have less downtime, and end up with a system that's more stable and works well together.

As we continue to evolve, using automation and AI for testing becomes essential—not just to work faster, but to empower our teams. We strongly believe, when we use machines to automate repetitive tasks, our people can spend their time on tasks that requires critical thinking and creativity. This change makes people happier in their jobs and brings more value to the company.

Lastly, sustainability is at the core of our work. We're dedicated to cutting down on waste, using AI and networks, and staying in line with Telia's wider sustainability aims to ensure we work both efficiently and responsibly.

**Mattias Lundqvist**

Manager, Quality Engineering & Strategy, Telia



# Sector analysis

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Energy, Utilities, Natural Resources, and Chemicals



A futuristic tunnel of light trails in shades of blue, cyan, and magenta, curving into the distance. A dark car is positioned in the center of the tunnel, illuminated by a bright white light source at the end of the path.

**On the fast lane to  
shape the future of  
*Automotive***

## How is Quality Engineering accelerating the next wave of automotive breakthroughs?

### Axel Schoenwald

Head of Automotive, Sogeti Germany

### Andy Howard

Vice President, Head of Automotive, Capgemini Americas

### Franck Desautly

Automotive Solution Director, Capgemini Engineering

### Laurence Noel

Executive Vice President, Head of Global Automotive Industry, Capgemini Group



### Quality Engineering is driving the future of cars

The automotive industry is racing towards a future where vehicles are more than about the engines and wheels—they're becoming complex machines driven by intricate software and cutting-edge technology. As automobiles become more high-tech with electric cars on the rise, self-driving technology getting better, and new experiences for the vehicle occupants, coupled with the shift to software-defined vehicles (SDVs) with software-centric E/E architecture, the role of QE in the development process has become more crucial than ever!

Quality Engineering not only ensures that these advanced vehicles are safe, reliable, and road-ready, but also that they deliver an excellent user experience while following the increasing number of rules and regulations. This transformation from traditional, mechanical machines to tech-driven systems means that Quality Engineering is evolving. It's adapting to meet the demands of an industry pushing the boundaries of what vehicles can do. In this chapter, we'll explore the trends, challenges, and future directions of QE in the automotive sector.

#### The road to seamless synchronization

Today's cars are complex, interconnected systems. Every part, including infotainment systems, must sync with your smartphone or the vehicle's safety features. And now with the rise of Electric Vehicles (EVs), this becomes even more complex, introducing more challenges for automakers who are used to their old ways of working with combustion engines. Getting these systems

to work individually might be easy, but what's more important is ensuring they all integrate. With Quality Engineering in the picture, every piece, whether software or hardware, works together seamlessly.

#### Taking the wheel

Autonomous driving is an exciting and challenging development in the automotive industry. Integrating Advanced Driver Assistance Systems (ADAS) demand rigorous testing to ensure seamless functionality. It is not just about the technology, but also safety and legal concerns associated with it. Who's responsible if an autonomous vehicle is involved in an accident? Quality Engineering plays a crucial role in addressing these tough questions, making sure these groundbreaking technologies are as safe as they are innovative.

#### The ultimate test drive? Check!

As cars become more like computers on wheels, the testing process requires a boost. Gone are the days of checking each part in isolation. Automakers are now focusing on end-to-end testing that ensures every system, whether developed in-house or by an external supplier, works in unison. This is vital for electric vehicles, where new advancements demand extra probing. Through Quality Engineering, these next-generation systems can be both reliable and groundbreaking. or by an external supplier, works in unison. This is vital for electric vehicles, where new advancements demand extra probing. Through Quality Engineering, these next-generation systems can be both reliable and groundbreaking.

### Smart move with Gen AI

Gen AI is the talk of the town in many industries, but its role in the automotive, especially in complex areas like autonomous driving, the stakes are high. Car manufacturers must have a careful and measured approach towards Gen AI, as its unpredictability could impact road safety. But Gen AI is also proving to be an efficient tool for engineers in the development process—helping them with tasks like designing test cases, automating routine tasks, and streamlining processes. Gen AI holds great promise in automotive engineering, but it is important to balance innovation with safety.

### Sustainability in motion

Sustainability is the biggest trend, and the automotive industry is getting on board. Many companies flaunt their eco-friendly initiatives, but is it as simple as it seems? It is more than just saving the planet! For instance, moving to cloud-based engineering tools can reduce a company's carbon footprint and costs. But here is what's important — we need to make sure these sustainability efforts are for real. With Quality Engineering in place, eco-friendly technologies work well and make economic sense too! Balancing environmental goals with practical needs isn't easy, but Quality Engineering does just that.

### What's driving today's advancements in automotive Quality Engineering?

**Software-defined vehicles (SDVs):** Imagine your car as a rolling smartphone, where software updates continually enhances your driving experience. over time. This software-centric approach tackles the growing complexity of vehicle technology, ensuring a unique user experience while meeting ever-increasing societal expectations, norms, and standards shift highlights the importance of reliable, secure, and high-performing software within the vehicle.

**Engineering in the driver's seat:** As vehicles become more software-driven, the Quality Engineering shifts from IT departments to engineering teams, ensuring software is as robust as the hardware.

**Navigating complexity with virtual testing:** As product and end-to-end testing grow more complex, leveraging virtual testing for software, electronic control units (ECUs), and vehicle systems helps tackle the problems of hardware and software dependencies. This method enables earlier checks of feature and software behavior fitting with the "shift-left" approach in the usual V-model development cycle.

**Driving innovation with simulated environment testing:** Leveraging cutting-edge 3D digital tools and simulated environments makes it possible to do more in-depth testing through virtual test drives. This method helps to carry out reliable tests for driver assistance and safety features, without

waiting for certain weather conditions or vehicle availability. This ensures a thorough coverage of critical corner cases.

### Steering towards the future

As the automotive industry races towards electrification, autonomy, and digitalization, Quality Engineering is the hero that makes it all possible. Imagine cars powered by electricity, equipped with smart features, and capable of driving themselves. This is the exciting future we're heading toward. But with new technologies like Gen AI and virtual testing, comes great responsibility.

How do we ensure these advanced technologies work flawlessly? It requires a careful, strategic approach! Quality Engineering ensures these technologies integrate seamlessly and perform reliably in real-world conditions. It's about preventing problems, pushing boundaries while keeping our eyes firmly on the road ahead, and ensuring every leap forward is exciting and dependable.

### Survey Watch

43%

Actively use Gen AI solutions like OpenAI, ChatGPT, or GitHub Copilot in Quality Engineering activities.

46%

Believe that the biggest risk in leveraging Gen AI for Quality Engineering is the significant effort required to train the model and prove its efficacy.

47%

Focus on learning and upskilling for quality engineers, with an enterprise-wide repository for learning pathways and usage tracked.

62%

Feel that the Quality Engineering process is not automated enough.



The future of  
*Manufacturing*  
is augmented

## Riding the wave of trends and innovations

### Tom van de Ven

Portfolio Director, Capgemini Engineering (NL)

### Atul Jadhav

Senior Director, ER&D, Capgemini India



Quality Engineering is experiencing a transformative shift with emerging trends that are redefining how we approach product development. Remember the days when it was all about production lines and assembly? That's history now. The spotlight now is on cutting-edge technologies that are revolutionizing how products are designed, tested, and brought to market.

As the manufacturing sector evolves, so does the role of Quality Engineering. Today, it's not just about meeting standards—it's about integrating innovative technologies to ensure exceptional performance and reliability.

Let's dive into how these emerging trends are shaping the future of manufacturing and pushing the boundaries of what's possible.

### Augmented Engineering: The future of manufacturing is here

One of the most exciting developments in manufacturing recently is Augmented Engineering. By integrating technologies like Virtual Reality (VR), Augmented Reality (AR), and Gen AI, engineers can revolutionize their workflow like never before. These technologies not only speed up model creation but also improve model-based testing, resulting in more efficient manufacturing and innovative product development.

### Gen AI: The design genius that's shaking up manufacturing

Gen AI is gaining traction across various industries, with its transformative potential also proving impactful in the manufacturing sector. Tools such as Copilot are enhancing

design processes by generating optimized component designs and improving iterative testing. For instance, generative design can optimize components like exhaust systems more efficiently and creatively than traditional methods. Although its adoption in manufacturing is still catching up to the IT sectors, the benefits are evident — *faster design iterations, improved test data generation, and enhanced product testing capabilities.*

### Hyper Automation: Secret sauce for speed and precision in manufacturing

Another emerging trend setting the stage on fire is hyper automation. It is transforming manufacturing by aiming to automate as many processes as possible. This includes reducing manual intervention and expediting production. The focus is on automating testing procedures and routine tasks to decrease time-to-market while maintaining rigorous quality standards. By integrating hyper automation, organizations can achieve faster production times and maintain high levels of Quality Engineering (QE).

### Mass Customization: How tailored are your products?

As consumer expectations shift towards personalized experiences, mass customization is becoming essential. The manufacturing industry must scale solutions to meet these demands. AI and data analytics enable manufacturers to efficiently create tailored products and services, enhancing customer satisfaction and loyalty. By integrating mass personalization, companies can ensure their products exceed individual consumer expectations.

## Sustainability in the manufacturing sector

Sustainability is a critical focus in today's world and the manufacturing sector is no exception. As industries strive for greener practices, quality engineers are focused on minimizing environmental impact throughout the product lifecycle. This includes using sustainable materials, reducing waste, and improving energy efficiency. Gen AI and other advanced technologies aid in optimizing designs for sustainability, leading to more eco-friendly production processes. Hyper automation also contributes by reducing resource consumption and waste through streamlined manufacturing processes.

## Integrating Quality Engineering in the product lifecycle and evolving priorities

Quality Engineering emphasizes early involvement throughout the product lifecycle. Engineers are now engaged from the inception stage, addressing aspects such as sustainability, compliance, and performance across all phases of development. This proactive approach is complemented by Agile methodologies, which foster continuous improvement and ensure that products meet dynamic consumer demands.

Balancing rapid product launches with robust quality remains a challenge, as the need for swift go-to-market strategies combined with stringent QE is crucial to avoid customer dissatisfaction and security issues. Additionally, with increasing cyber threats and potential product misuse, security has become a critical focus. Engineers must proactively identify and address vulnerabilities to protect customer trust and ensure the safety of products and systems.

## Embracing change: The future of manufacturing

As the manufacturing sector continues to evolve with new technologies and methodologies, embracing trends such as Augmented Engineering, Gen AI, and Hyper automation will be crucial for driving innovation and maintaining high standards. By leveraging AI-driven tools, focusing on mass personalization, and prioritizing sustainability, organizations can achieve accelerated design, enhanced testing, and efficient product development.

This approach will set the stage for a future marked by rapid innovation and rigorous QE in the manufacturing sector.

## Survey Watch

62%

Respondents from the manufacturing sector feel that higher productivity is one top outcomes achieved through Gen AI.

55%

Feel that data breaches present the biggest risk in leveraging Generative AI solutions for quality engineering.

61%


Believe that lack of a clear strategy to validate the usefulness of Gen AI solutions is a major challenge in the manufacturing sector.

83%

Use Robotic Process Automation to drive efficiencies.

79%

Organizations find complex tooling a challenge towards integrating test automation into CI/CD pipelines.



**Navigating  
the future of *Retail***

## Embracing technology, overcoming challenges, and adapting to consumer demands

### Lauren Quart

Vice President, Global Client Partner, Capgemini Americas

### Deepak Kumar

Associate Vice President, Group Client Partner - Starbucks, Sogeti USA



Today, a few key trends are reshaping the CPR industry. Technology and changing consumer habits are driving this transformation, challenging consumer products and retail companies to innovate and embrace new trends to stay ahead.

### Geopolitical and economic challenges

One major challenge for CPR companies is the impact of geopolitical issues on global supply chains. Conflicts like the one in Ukraine and tensions between Japan and China are causing disruptions, leading to higher costs and supply chain complexities. Additionally, the rising cost of commodity goods is putting pressure on consumer products companies, which often pass these costs onto consumers. This, in turn, affects retailers as higher prices strain their top lines, creating a challenging commercial environment exacerbated by inflation. We've noticed that some retailers are taking margin hits due to these rising costs, so that it doesn't affect the consumers.

### Labor and automation

Labor costs and talent retention are other critical issues. With labor becoming more expensive and harder to find, companies are investing heavily in technologies that can enhance productivity and reduce dependency on human labor. Innovations like frictionless checkouts and autonomous stores, exemplified by Amazon Go, are becoming more prevalent. These technologies not only streamline operations but also address the labor shortage by automating tasks traditionally performed by employees.

### Technological investments in manufacturing

On the consumer products side, there is a significant focus on integrating advanced technologies into manufacturing processes. The convergence of IT and OT is leading to the adoption of machine learning and vision technology on production lines. These technologies enable real-time quality control and process optimization, ensuring higher efficiency and product quality.

### Shifts in consumer buying channels

The retail landscape is also witnessing a major shift in consumer buying channels. By 2027, online channels are expected to become the largest global sales channels, even surpassing traditional brick-and-mortar stores in sectors like supermarkets. This shift is driving both retailers and consumer products companies to adapt to new sales channels and meet consumer demands for convenience and flexibility. Consumers now expect to purchase products anytime, anywhere, and from any channel, which is pushing companies to invest in omnichannel strategies.

### Retail media and data monetization

Retailers are increasingly leveraging their online platforms to generate additional revenue through retail media and advertising. This trend is accompanied by significant investments in retail data analytics, enabling companies to monetize data and gain insights into consumer behavior. Consumer products companies, which traditionally relied on point-of-sale data, are now navigating the complexities of retail media to track investments and optimize marketing strategies.

### Sustainability and purpose-driven initiatives

Sustainability is another critical trend, with consumers showing a preference for sustainable products. While consumers may not be willing to pay a premium for sustainability, they are likely to choose sustainable options if prices are comparable. This consumer behavior is driving retailers and consumer products companies to adopt sustainable practices and align their offerings with environmental and social responsibility goals.

### Quality and testing challenges

The increasing reliance on technology and AI in retail and manufacturing introduces new challenges in QE and testing. Ensuring data quality and the accuracy of AI algorithms is paramount, as companies depend on these technologies for decision-making and operational efficiency. The rapid deployment of AI models necessitates robust testing environments to validate their performance and reliability.

### Evolving skill sets in Quality Engineering

A significant new shift reflects the increasing integration of AI and advanced analytics in the industry. Companies are investing in AI modeling and data governance, necessitating quality engineers who can navigate these complex technologies.

For example, companies like P&G are evolving towards a product-oriented, end-to-end platform structure to fully leverage DevOps and Agile methodologies. This transition requires robust development skill sets to support the DevOps ecosystem, while also emphasizing AI and data-related skills. Quality Engineering teams are becoming more integrated within Agile teams, focusing on both development and QE.

### Adoption of Gen AI tools

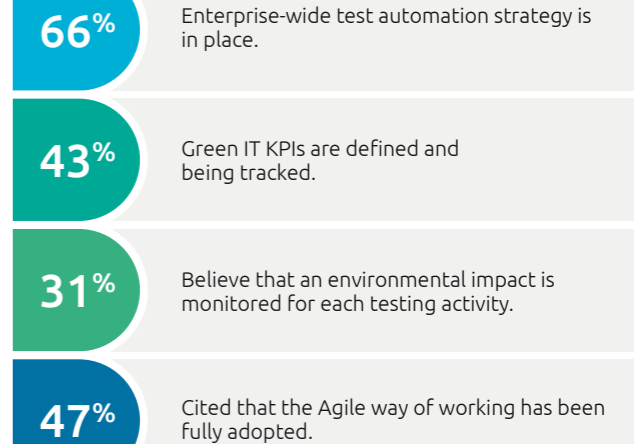
The adoption of generative AI tools, such as ChatGPT and Copilot, is also gaining traction within the industry. Companies are experimenting with these tools to enhance various aspects of development and testing. While some companies are developing their own in-house AI tools, others are leveraging external solutions for specific use cases. The integration of generative AI tools is still in its early stages, with companies exploring their potential to improve efficiency and decision-making.

### New futures – Trends in focus

- **Unlock channel growth:** Helping retail and consumer products companies navigate new sales channels to meet evolving consumer demands.
- **Adapt to compete:** Addressing productivity challenges through intelligent supply chains and manufacturing, while integrating AI to drive efficiency and sustainability.
- **Lead with purpose:** Brands and retailers must prioritize sustainability, as consumers prefer sustainable products over non-sustainable ones when prices are comparable.

As these trends continue to evolve, the ability to innovate and respond to market dynamics will be crucial for success in the retail sector.

### Survey Watch



# Quality in *Healthcare* *and Life Sciences*

## Balancing tradition with innovation

### Brian Eden

Vice President, Global Life Sciences Technical Operations, Capgemini Group



Quality in healthcare and life sciences is not just important – it is the backbone of the industry. In a field where decisions directly impact lives, quality ensures patient safety and treatment effectiveness. However, the healthcare sector’s strict rules, regulations, and cautious approach can sometimes slow the adoption of new technologies and innovation, making it challenging to create that delicate balance between tradition and innovation.

### Bridging the gap between compliance and innovation

Healthcare’s focus on quality is inevitable in safeguarding human lives, but this commitment can also lead to resistance to change when new methods or technologies are introduced. To tackle this, organizations must comply with regulations, but also explore ground-breaking innovations, such as new therapies and personalized medicines. These advances can not only improve patient care, but also motivate and engage the workforce to move forward.

### Three key challenges in maintaining quality include:

- 1. Capacity constraints:** Quality teams are often overwhelmed by regulatory demands. Improving efficiency is essential to free up resources for innovative solutions.
- 2. Slow technology adoption:** The healthcare sector is usually slow to adopt modern technologies, making it difficult to standardize processes and integrate

advanced analytics. This challenge is now catching up without compromising compliance.

- 3. Regulatory rigidity:** Some regulatory bodies like the FDA are progressive, but others still remain traditional.

### Dose of innovation

Emerging technologies like AI and automation can help address these current challenges. Gen AI can impact the transition from proof of concept to full-scale implementation by efficiently handling large data sets. However, it carries risks, like bias, which could lead to overlooked therapeutic options or diseases and potentially result in incorrect treatments. Ensuring data quality is crucial for AI effectiveness in drug development. Automation can also help quality teams manage routine tasks, such as data entry or basic analysis, allowing them to focus on more complex, valuable work. This shift in working enhances efficiency and drives the workforce to move forward.

As the industry evolves, the role of quality in sustainability becomes more important than ever. Quality teams have an opportunity to lead sustainability initiatives, making sure that the products designed are both effective and environmentally friendly. Whether through material selection, managing the lifecycle of antibiotics preventing resistance, or reducing waste in production processes, quality professionals play a critical role in shaping a sustainable future for healthcare and life sciences. They also support sustainability by selecting local, high-quality vendors over distant ones to reduce CO2 emissions and improve product quality.

## Digital checkup!

### IT trends reshaping healthcare’ future

Many IT trends are shaping the healthcare and life sciences sector:

- 1. Consolidation of IT architecture:** There’s a strong need to consolidate and optimize systems that support quality and manufacturing. This includes integrating older systems like SAP with newer ones, such as Veeva Vault for document management.
- 2. Generative AI and computer vision:** Gen AI allows organizations to extract information from data sets interactively, without needing a perfect data structure. Combined with computer vision, these technologies can handle complex tasks like interpreting manuals.
- 3. Data model modernization:** Updating the data model is crucial for leveraging data across various systems. The trend is moving toward lighter, more flexible solutions, enabling quicker scaling of applications

### Quality reboot

Quality culture is important for success in the healthcare and life sciences sector. Traditionally conservative, there’s now a growing focus on integrating quality teams into product-centric organizations. This approach aligns quality with lean manufacturing principles, allowing for more dynamic operations. For example, creating “factories within factories” dedicated to specific high-volume products can streamline processes and improve efficiency. However, quality is often used as a reason to avoid change. It is important to distinguish between necessary caution like ensuring patient safety and unnecessary barriers to innovation.

### Breaking new ground in quality

The healthcare and life sciences sector faces challenges in balancing quality with innovation. By leveraging AI, automation, and a strong quality culture, organizations can navigate these challenges, ensuring that quality and innovation go hand in hand to deliver better outcomes for patients and the industry.

## Survey Watch

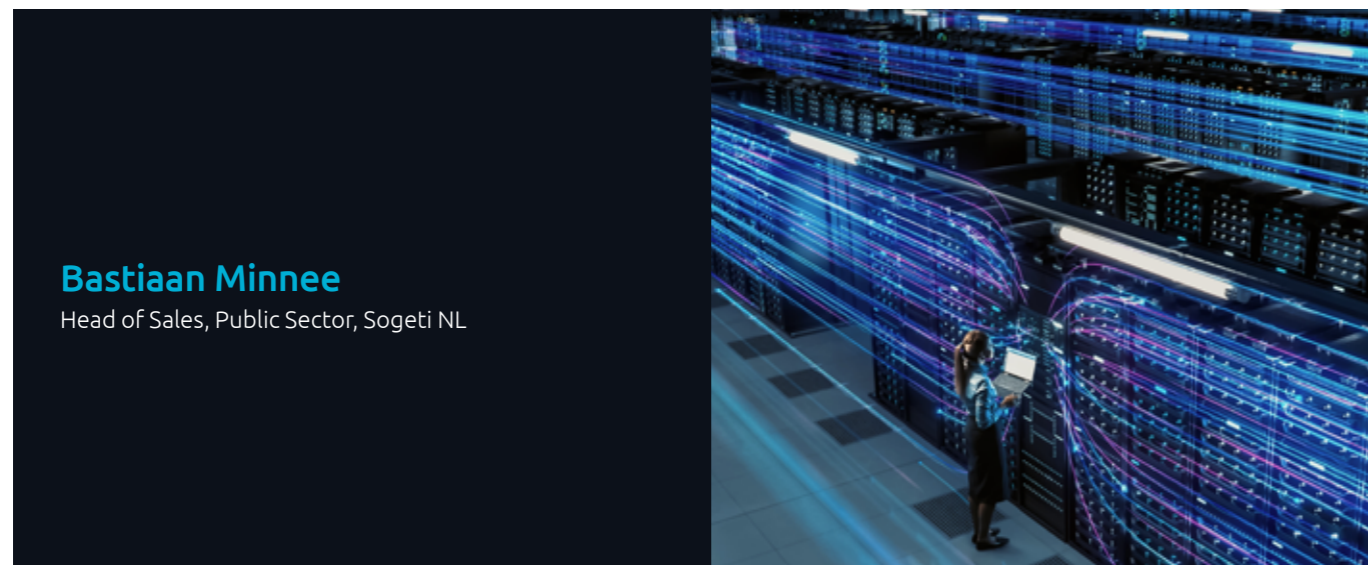
- 28%** Actively use Generative AI solutions like OpenAI, ChatGPT, or GitHub Copilot in Quality Engineering activities.
- 52%** Highlight the lack of a clear strategy for validating the usefulness of Gen AI solutions as a key challenge their organization is currently facing.
- 26%** Implement efficient practices in their Quality Engineering and testing processes to enhance sustainability.
- 40%** Focus on learning and upskilling for quality engineers, with an enterprise-wide repository for learning pathways and usage tracked.
- 32%** IT organizations have been trained and/or have some awareness on the subject of sustainability to drive various sustainability initiatives.





Shaping the *Public Sector* with AI

## Embracing Cloud and AI for enhanced efficiency



**Bastiaan Minnee**  
Head of Sales, Public Sector, Sogeti NL

The public sector is gradually embracing cloud technology, though it's lagging other industries that have already undergone significant transitions. While sectors like logistics and energy have been leveraging cloud solutions for over a decade, public organizations are just starting to explore its potential. Capgemini, Sogeti and our partner brands have been instrumental in guiding other industries through this shift, and now, we are ready to apply our expertise to the public sector. This is a pivotal moment for public organizations, as they begin to unlock the benefits of cloud technology, including enhanced efficiency, scalability, and improved service delivery.

### Growing curiosity about AI

In addition to cloud adoption, there is a growing curiosity about AI within the public sector. However, this interest hasn't yet translated into widespread implementation. Many public sector organizations are cautious about AI, with a certain level of distrust and hesitation holding back full-scale adoption. That said, experimentation with AI is underway, and as these organizations become more comfortable with the technology and recognize its potential, we expect a more significant shift toward AI-driven solutions. This gradual exploration of AI could lead to innovative applications that enhance public services, streamline operations, and improve the quality of service.

### Our role in AI experimentation

We are deeply involved in AI experimentation, collaborating closely with our clients to explore the possibilities of generative AI. Through our Gen AI Amplifier initiative, we are focusing on boosting productivity by implementing AI-driven solutions. One area of experimentation involves generative AI chatbots, which are currently being tested both internally and in proof-of-concept phases with public sector clients. For example, these chatbots are being deployed to enhance internal service desks, improving efficiency and reducing response times. These early

experiments are crucial in integrating AI into more complex public sector processes and could pave the way for broader AI adoption in the future.

### Importance of predictability in Quality Engineering

When it comes to Quality Engineering, predictability is a top priority for our clients. While cost and speed are important, being able to rely on consistent budgeting and timing is often more critical, especially when strict deadlines tied to new legislation are involved. Ensuring predictability through Quality Engineering helps catch defects early, minimizing risks and avoiding costly delays. This emphasis on predictability is key to maintaining trust and delivering high-quality results, particularly in sectors where timelines and budgets are tightly regulated.

### The AI revolution and Shift-Left approach

The AI revolution, particularly the shift-left approach, is driving the need for faster, cheaper, and more predictable solutions. While speed and cost-efficiency are important, predictability remains the most crucial factor. However, the ongoing Agile transformation in the Quality Engineering sector presents challenges. About half of the industry has already embraced

this transformation, moving from centralized to decentralized Quality Engineering. Although decentralization enhances productivity and gives teams more autonomy, it can also create challenges in specialized areas like cloud, security, and automation. As teams gain more authority, there's a risk of losing essential expertise in these areas, which must be carefully managed to maintain a balanced approach.

### Managing complexity in Cloud-based environments

Cloud-based environments are becoming increasingly complex, especially with deeper integrations involving third-party systems. This complexity makes testing ecosystems more challenging for organizations. To address this, many clients are adopting contract-based testing, which helps manage large systems with numerous microservices and reduces reliance on senior professionals for oversight.

As Agile transformation progresses, automation is becoming essential to reduce time to market. While automation has advanced in testing, other areas like requirements and coding are still in the early stages. The hope is that innovations like generative AI will further enhance automation while keeping costs under control, offering a glimpse of a future where AI-driven solutions play a more prominent role across industries.

As public organizations begin to embrace these innovations, the expertise and guidance of industry leaders will be crucial in navigating this transition. By focusing on predictability, leveraging AI, and managing the complexities of cloud environments, the public sector can achieve significant advancements.

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As public organizations begin to embrace these innovations, the expertise and guidance of industry leaders like Sogeti will be crucial in navigating this transition. By focusing on predictability, leveraging AI, and managing the complexities of cloud environments, the public sector can achieve significant advancements.

### Survey Watch



A futuristic city street at night, illuminated by vibrant blue and purple neon lights. A person in a dark jacket and red skirt stands with their back to the camera, interacting with a large, illuminated kiosk. The street is paved with dark tiles, and the surrounding buildings are modern and glass-fronted, reflecting the city lights. The overall atmosphere is high-tech and digital.

# Emerging trends and challenges in the *Financial Services* industry

## The evolving role of Quality Engineering

### Anand Moorthy

Vice President & Global Head, Quality Engineering & Testing, Financial Services, Capgemini

### Nilesh Yeola

Senior Director, Capability Unit Leader, Quality Engineering & Testing, Financial Services, Capgemini India

### Sagar Chitre

Practice Director, Quality Engineering & Testing, Financial Services, Capgemini UK



Quality Engineering is undergoing significant transformations, particularly within the Financial Services (FS) sector. As organizations navigate these changes, several trends are emerging that are redefining the practices of Quality Engineering.

### Diversifying geographical focus

A key trend emerging is the shift away from relying on a single country as the main outsourcing provider. Many financial institutions are now actively seeking to “de-risk” by diversifying their geographical focus. Approximately 50% of financial institutions are now looking to reduce their dependency on IT services from India and the US, instead opting to relocate resources to Latin America (LATAM). This move not only reduces costs but also aligns with the growing trend of balancing the workforce across different time zones.

### Challenges of shifting IT outsourcing

The shift towards emerging markets like Latin America does present challenges, particularly concerning language barriers and niche skill sets. For example, Mexico has become the fourth-largest IT market, with a growing pool of IT professionals and STEM graduates. However, language barriers and specific skill shortages, such as in advanced tools, pose significant hurdles. Despite these challenges, the trend towards Latin America is accelerating, highlighting a need for adaptation to new market realities.

### Technological advancements and Gen AI

Another significant trend is the adoption of Gen AI across the banking industry. While the FS sector has been slower to adopt

this technology due to concerns over data security, there is now a clear shift towards integrating AI-driven solutions. Gen AI is being integrated into various tools and platforms, enhancing functionalities and efficiency.

As Gen AI becomes more prevalent, it is expected to impact Quality Engineering significantly. AI is anticipated to shift roles and responsibilities, with tools aiding in various tasks such as code creation and automating test scripts. With AI becoming embedded in everyday tools, its role in Quality Engineering is likely to grow. For instance, tools like Microsoft Teams are employing Gen AI to streamline tasks such as note-taking, signaling a broader trend towards incorporating AI into everyday business processes.

### Gen AI and Quality Engineering: Evolving roles and skills

Gen AI is expected to significantly impact the roles of developers and testers, potentially leading to a more generalist approach. As Gen AI takes on more repetitive tasks, there will be less need for entry-level positions, with a greater emphasis on mid-level and senior roles that require domain expertise and the ability to work with advanced AI tools.

Looking forward, there is a need for accelerated upskilling programs to ensure that quality engineers remain relevant. The role of the quality engineer will not vanish, but it will evolve- with focus on more complex tasks like security testing and validation. The shift towards more strategic and technically sophisticated roles will demand continuous learning and adaptation.

### Shifting organizational structures

The organizational structure of Quality Engineering teams is also evolving. The industry has moved from ad hoc testing to more centralized Testing Centers of Excellence (TCOEs) and now towards a federated, product-aligned model. However, with the rise of Gen AI, there may be a shift back towards more centralized teams or a hybrid model that combines elements of both centralized and federated structures. The roles within these teams are also changing, with a growing need for full-stack skills and expertise in areas like cloud computing and data management.

### Adapting to transformation in Quality Engineering

The shift towards diversified outsourcing, the rise of Gen AI, and the evolving organizational structures all point to a future where flexibility, adaptability, and a willingness to embrace new technologies will be crucial for success. As Gen AI continues to mature, it will reshape the roles and skills needed in Quality Engineering, emphasizing the importance of strategic and specialized knowledge. The next few years will be critical in navigating these changes and ensuring that Quality Engineering practices continue to align with the evolving demands of the industry.

## Survey Watch

38%

Actively use Gen AI solutions (LLM and SLM models) like OpenAI, ChatGPT, or GitHub Copilot for Quality Engineering activities in the financial sector.

66%

Respondents believe that improved testing coverage leads to a higher degree of confidence in IT through test automation.

65%

Believe challenges in integrating test automation into CI/CD pipelines primarily due to legacy architecture/tech.

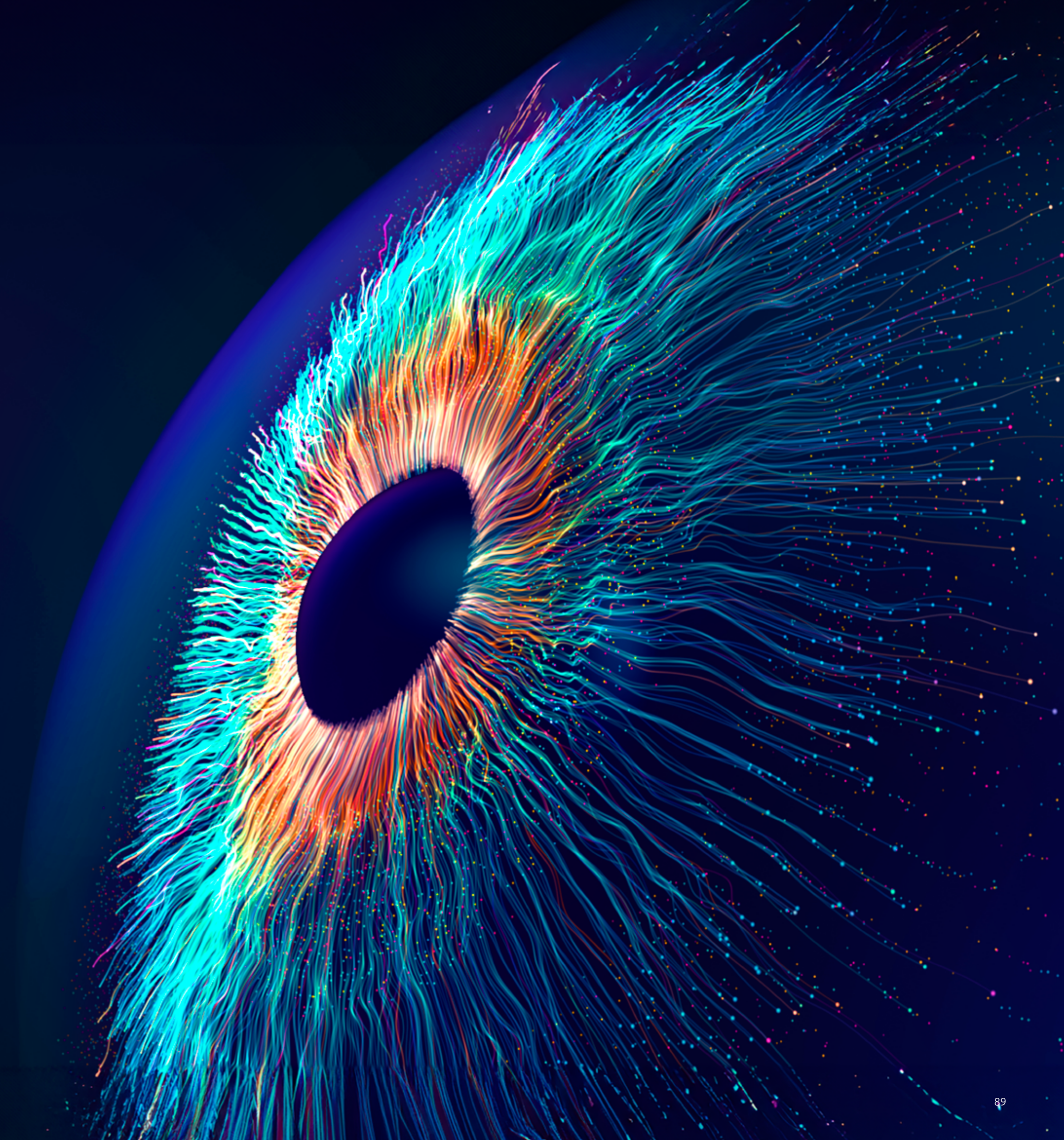
35%

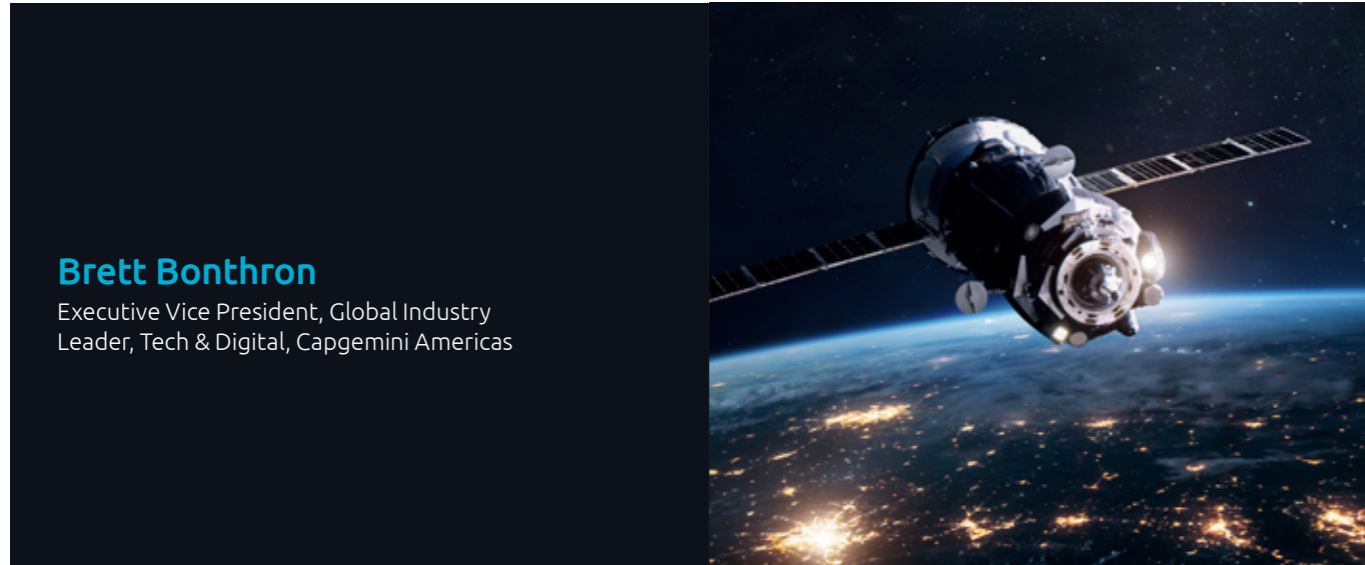
Focus on Green IT Principles includes documenting and measuring environmental, social, and governance (ESG) parameters as key performance indicators.

75%

Responded that Quality Engineering skills are considered the most critical for Quality Engineering associates in the financial sector.

**Elevating Standards:**  
**How does *Telco, Media***  
***and Technology* test**  
**the boundaries**  
**of innovation?**





**Brett Bonthron**

Executive Vice President, Global Industry Leader, Tech & Digital, Capgemini Americas

The Technology, Media, and Telecommunications (TMT) industry is experiencing major changes due to rapid technological advancements and the rise of Generative AI (Gen AI) – a central focus in Quality Engineering. As experts in managing disruptions, TMT companies must quickly adapt to every new development in AI and the internet.

Here’s the complexity of the challenge: TMT companies must integrate generative AI into their products while also developing essential tools like ChatGPT, Microsoft Copilot, and Gemini. Additionally, they need to test these AI tools and leverage AI to improve their testing processes, tackling issues such as AI hallucinations and ensuring consistent quality over time.

Given how closely intertwined our lives are with each element of this sector, failure is not an option. The pressing question is: How are the recent developments reshaping how organizations operate?

**Data quality? The ace up TMT’s sleeve!**

As the TMT sector grapples with the complexities of Gen AI integration, data quality remains a cornerstone of the TMT sector’s operations. Despite challenges with test data quality, TMT organizations excel in handling structured data, which gives them a significant advantage in adopting and adapting to Gen AI. Their expertise with structured data allows them to train models more accurately and efficiently, ensuring that AI tools perform better. This strength in data management is a crucial asset as TMT companies explore the dual challenges of developing and testing AI-driven products.

**A toast to internal testing**

Many organizations focus heavily on developing and launching new tools, often focusing on external projects while internal efficiency takes a backseat. This “Cobblers’ Children Syndrome” can sometimes leave their own internal operations under-optimized.

Some independent software vendors (ISVs) have realized this and successfully refined the process of testing and validating their tools before market release. The key takeaway? – Drink your own champagne! Go beyond the standard quality testing phase by evaluating the impact within your own company. This approach not only provides early and intimate access to your tools—providing a competitive edge—but also empowers your sales and marketing teams with firsthand insights when bringing the solution to market. With higher stakes, organizations are motivated to rigorously test their offerings before introducing them into the consumer world.

That said, the need for critical testing is still new, and while organizations are slowly understanding the implications of overlooking it, the impact will be increasingly apparent in the future. As we enter a world where disruptions could cause significant harm, the risks of inadequate testing are magnified. Imagine your firewall systems going down for even 30 minutes—such a lapse can be devastating.

**Rolling with the automation flow**

Automation is a critical component of Quality Engineering in the TMT sector. Yet, despite the sector’s technological prowess, the WQR 2024 survey shows that test automation levels are comparable to other industries. This can be attributed to the broad scope of TMT, encompassing everything from semiconductor manufacturing to consumer electronics and software platforms.

Certain areas within TMT, such as static systems in telecommunications, offer significant opportunities for automation due to their relatively stable nature. However, the rapid pace of innovation in other areas, such as software development and feature deployment, makes achieving high levels of automation challenging. The sector must navigate these dynamics to enhance testing efficiency and reliability.

**Green tech, lean tech**

Sustainability has emerged as a top priority, driven by the environmental impact of technology production and operations. The survey revealed that most organizations prioritize sustainability, with Green IT principles becoming a key focus area and even a KPI for many. This is particularly relevant for data centers, which have a substantial carbon footprint exceeding that of the airline industry.

However, the sector relies heavily on electricity-intensive processes, and rare materials in manufacturing pose challenges. Additionally, tracking scope 3 emissions remains inadequate, especially given the scale of tech operations. These factors highlight why organizations need to intensify their decarbonization efforts and adopt more sustainable practices. Fortunately, there’s a growing emphasis on circularity, reflected in the concept of “out with the old (tech), in with the new (tech),” alongside efforts to reduce waste, driven by innovations in energy efficiency and supply chain sustainability.

**Testing the waters to deliver a new level of responsibility**

As the TMT sector evolves, agile methodologies and intelligent product validation have become indispensable due to the growing complexity and technical nature of its products. This is especially vital for “chip-to-industry” products embedded in hardware (like telecommunications infrastructure) and intelligent platforms, where errors can have significant consequences.

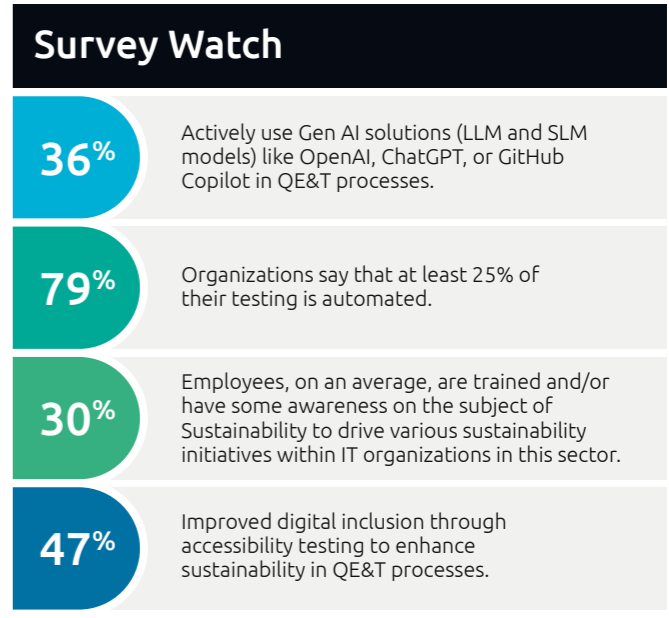
The sector requires strong testing frameworks to guarantee reliability and performance that meet the highest standards of quality and customer satisfaction. Survey results highlight that organizations prioritize coding skills and data analytics for quality engineers, emphasizing the need for precise and efficient

testing processes. Consequently, this focus creates numerous opportunities for testing automation and a comprehensive understanding of the entire ecosystem.

**Wired for quality**

The TMT sector often deals with the very fabric of the internet, and as our reliance on intelligent applications and services grows, it’s essential that quality testing standards remain consistently high. To stay ahead, organizations must seize the opportunity to test and deploy their own AI tools, ensuring that automation keeps pace with the rapid innovation in the industry while also maintaining a focus on sustainability.

Each year, we can expect to reach new heights in innovation, automation, the sophistication of AI tools, and quality testing. It will be fascinating to observe how these advancements influence one another over the coming year.





# Quality Engineering in the *Energy Sector*

## Trends and technologies that are shaping tomorrow



### Dru K. Hawkins

Group Vice President, Energy Sector, Capgemini Americas

### Jeff Larsen

Vice President, Resources Industry Sector, Capgemini Americas

As the energy sector faces mounting pressures to reduce operational costs and drive strategic investments, the role of Quality Engineering has become more critical than ever. As the industry faces rapid technological advancements like Gen AI, cloud computing, and much more, the importance of robust Quality Engineering processes has never been greater.

### The rise of Gen AI: Opportunities and cautions

The energy sector is witnessing a cautious but growing adoption of Gen AI. Currently, its use is largely confined to internal operations, with companies conducting proof-of-value assessments to balance productivity gains against potential risks like copyright infringement and data misrepresentation. Despite these challenges, the adoption of Gen AI reflects its transformative potential and its role in driving future advancements in the sector.

Beyond Gen AI, other AI technologies- like digital twins, Augmented Reality (AR), and Virtual Reality (VR) are making inroads in the energy sector. Digital twins, for instance, are being used to optimize processes by creating virtual replicas of physical assets. However, the oilfield services industry is still in the early stages of adopting AI in mainstream activities. Organizations are defining ethical guidelines and benchmarking the benefits of AI before fully integrating these technologies into their operations.

### Cloud computing and Edge devices: Optimizing IT infrastructure

Cloud computing, now a cornerstone of the energy sector's IT strategy, has moved from initial implementation to optimization. Major players have established their cloud environments and

are now focused on leveraging the cloud's scalability to adjust resources according to demand. This optimization aligns with the original goals of cloud adoption—realizing cost savings and enhancing operational efficiency. Meanwhile, Edge computing remains a top trend too, although it has yet to reach full maturity in the industry.

### The criticality of Quality Engineering

QE remains a critical component across the entire value chain in the energy sector. Without a rigorous, scalable quality plan, a company's reputation is at risk. Organizations are increasingly focused on optimizing the execution and repeatability of QE programs. This is where Gen AI and automation play a pivotal role, ensuring that software products, business processes, and even in manufacturing where something as small as a drill bit meet the highest standards.

### Quality Engineering in an Agile and DevOps world

Quality Engineering in the energy sector is changing rapidly as the industry evolves. Traditionally, several organizations maintained Centers of Excellence (CoEs) for QE, especially for external software products. These CoEs operate independently from product owners, ensuring objectivity and a focus on performance metrics.

However, for internal business applications, QE is increasingly being embedded within Agile teams itself. This integration allows QE to be part of the Scrum process, ensuring that quality checks are continuous and aligned with development cycles. This trend reflects the sector's gradual shift towards digital transformation, with more companies offering insights and data analytics solutions to their customers.

### Sustainability in the energy sector

Sustainability is central to today's business strategy, extending well beyond carbon footprint management. It's essential for organizations in the energy sector to weave sustainability into their core operations rather than relegating it to the sidelines. This means rethinking sourcing, production, and waste management to support a circular economy. By focusing on resource efficiency and waste reduction, businesses can enhance both environmental impact and long-term viability.

### Balancing technological innovation with Quality Engineering

As the energy sector continues to embrace advanced technologies, the biggest challenge will be ensuring their ethical and effective use. Managing change within organizations will be crucial as AI and other technologies evolve. QE processes must also adapt to support these advancements, ensuring that they drive repeatable, reliable outcomes.

As the industry navigates the complexities of digital transformation, QE will continue to be critical in safeguarding brand reputation, optimizing operations, and supporting the ethical adoption of new technologies.

### Survey Watch

61%

Believe that data breaches are considered the biggest risk in leveraging generative AI solutions for Quality Engineering.

48%

Use a combination of open-source and commercial off-the-shelf (COTS) tools for test automation tooling.

47%

Prioritize sustainability, considering it important for staff, supply chain, and customers, including ESG aspects.

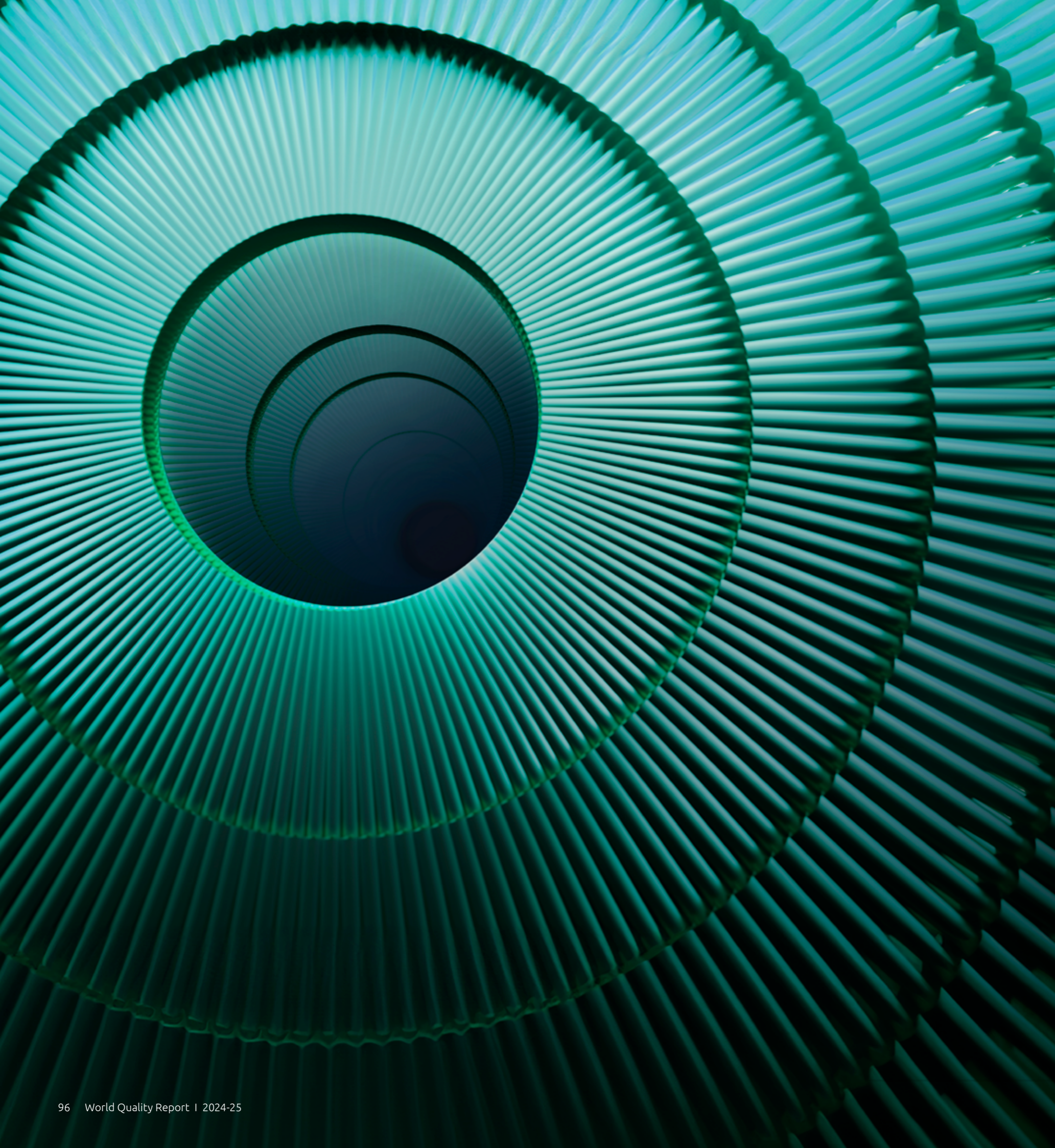
60%

Would like to utilize Gen AI for Test Automation script conversion from one tool to another.

20%

Believe that reliability, data quality, and security hold equal importance alongside functional correctness when determining the most critical aspects of validating an intelligent product.





# About the survey

## *World Quality Report 2024-25*

The World Quality Report 2024-25 is based on research findings from 1,775 interviews conducted during May and June 2024 by Coleman Parkes Research. Each interview lasted approximately 30 minutes, and the interviewees were all senior executives in corporate IT management roles, representing companies and public sector organisations across 33 countries.

The interviews this year were based on a questionnaire of 48 questions. Interviewees were asked a subset of these questions, depending on their role in the organisation, to ensure the responses were relevant and meaningful. In addition to the quantitative data collected, the research was supplemented by in-depth interviews to provide deeper insights into key themes, supporting the overall analysis and commentary.

This year, advanced AI-driven tools were integrated into the research process to enhance data quality. These tools played a critical role in automating data validation and cleaning, reducing human errors, and ensuring the data accurately represented market conditions. AI also supported the recruitment process, ensuring a broader reach of participants while maintaining the integrity of responses and preventing duplication.

Participants were selected to ensure sufficient coverage of different regions and vertical markets, providing industry-specific insights into Quality Engineering and testing challenges. The methodology ensured that the sample was representative of the wider population, both in terms of size and demographic profile.

For a robust and reliable study, the sample size is determined based on the population being surveyed. In a business-to-business (B2B) market research study, the typical sample size is around 500 companies, but the World Quality Report 2024-25 used a larger sample of 1,775 interviews, drawing from enterprises with over 1,000 employees (22%), more than 5,000 employees (32%), and companies with over 10,000 employees (34%), and multiple industries globally. This allowed for meaningful comparisons with previous years' reports, where the same questions were asked.

During the interviews, the questions were linked to each participant's job title and responses to earlier questions, ensuring a personalised and relevant experience. As a result, the number of respondents for each survey question varies depending on the flow of the interview.

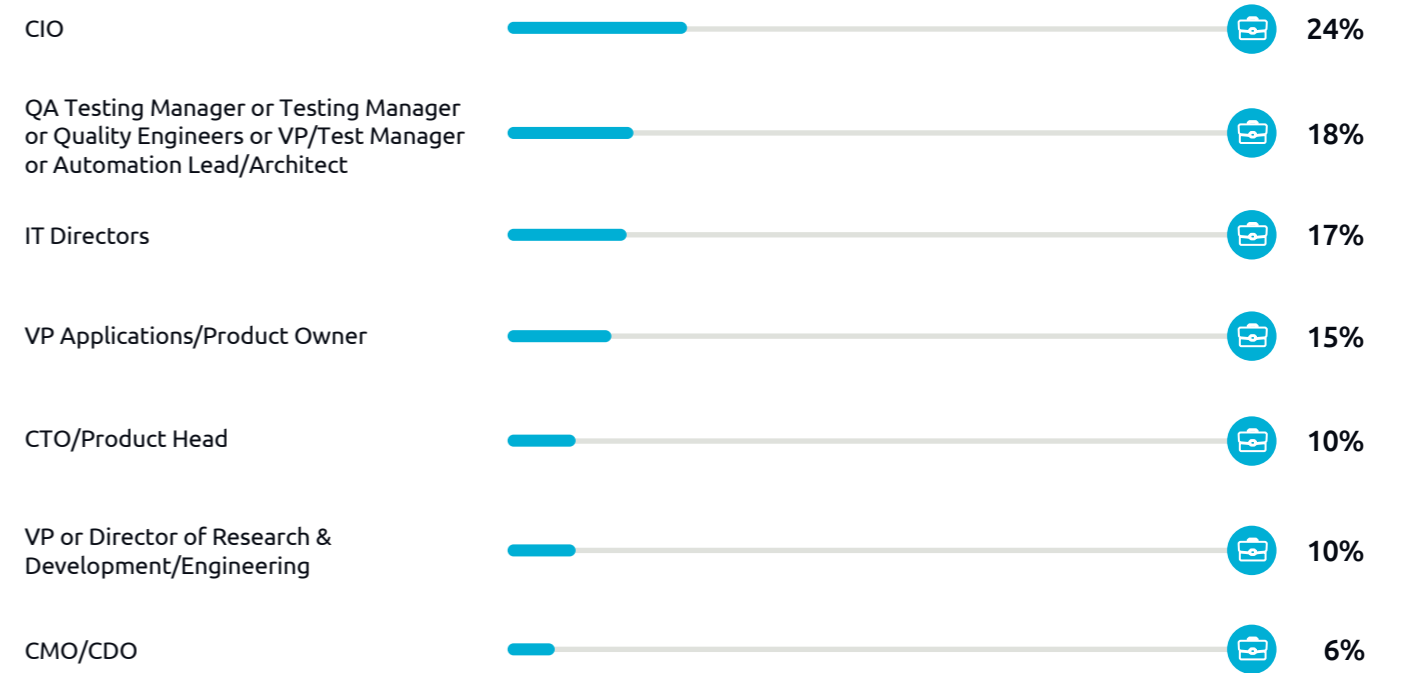
The survey questionnaire was designed by Quality Engineering experts from Capgemini, Sogeti, and OpenText (the study's sponsors) in consultation with Coleman Parkes Research. The 46-question survey covered a range of software Quality Engineering and digital assurance topics, and the qualitative data from in-depth interviews enriched the analysis.

This rigorous approach, combined with the use of advanced AI technology, ensures that the World Quality Report 2024-25 remains a trusted source of insight into global trends, challenges, and opportunities in Quality Engineering and testing.

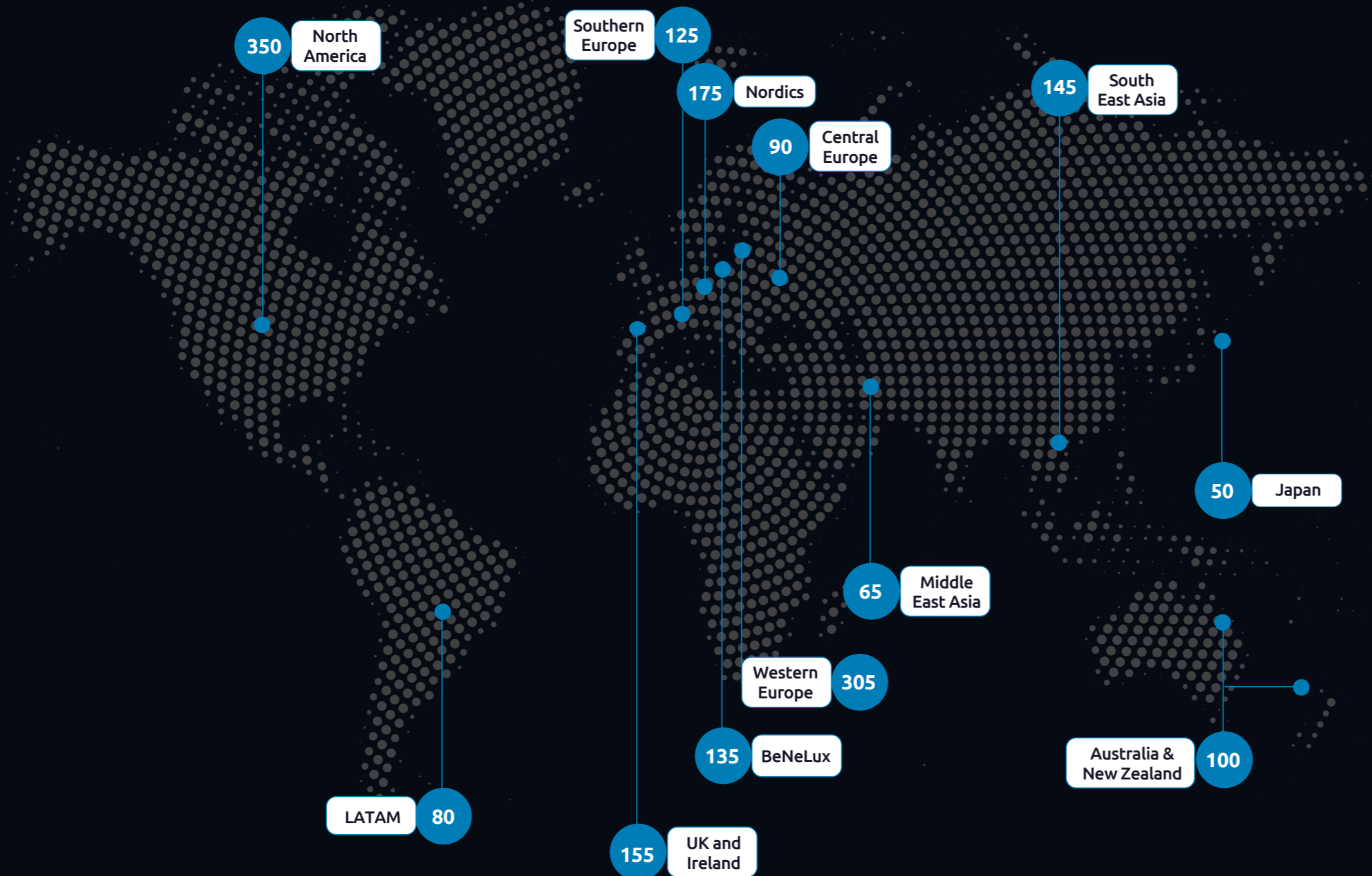
## Interviews by sectors



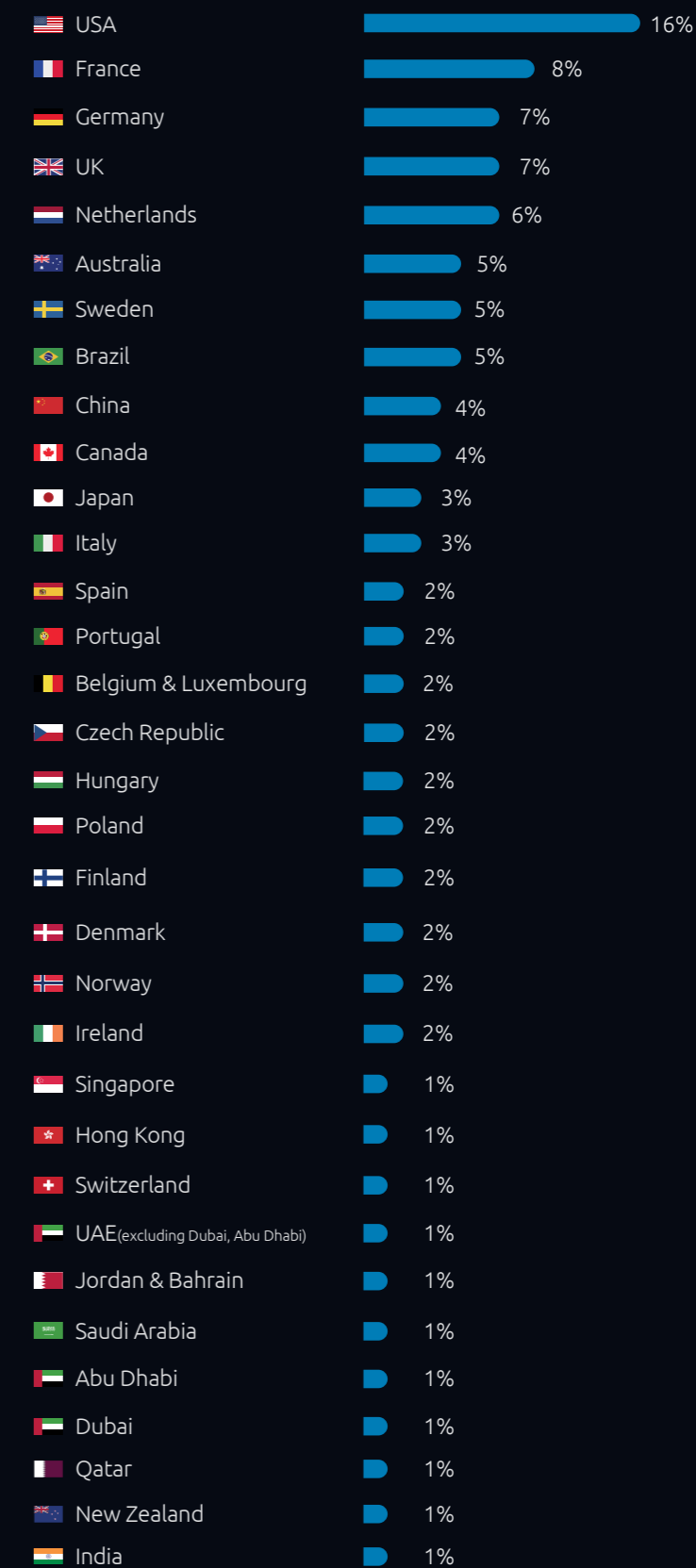
## Interviews by job titles



## Interviews by country



## 33 Countries



# About the sponsors

## World Quality Report 2024-25

### About Capgemini and Sogeti

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 340,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market leading capabilities in AI, cloud and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2023 global revenues of €22.5 billion.

Part of the Capgemini Group, Sogeti makes business value through technology for organizations that need to implement innovation at speed and want a local partner with global scale. With a hands-on culture and close proximity to its clients, Sogeti implements solutions that will help organizations work faster, better, and smarter. By combining its agility and speed of implementation through a DevOps approach, Sogeti delivers innovative solutions in quality engineering, cloud and application development, all driven by AI, data and automation.

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# Thank you

## Capgemini, Sogeti, and OpenText would like to thank

The 1,775 IT executives who took part in the research study this year for their time and contribution to the report. In accordance with the UK Market Research Society (MRS) Code of Conduct (under which this survey was carried out), the identity of the participants in the research study and their responses remain confidential and are not available to the sponsors.

All the business leaders and subject matter experts who provided valuable insight into their respective areas of expertise and market experience, including the authors of the country and industry sections and subject-matter experts from Capgemini, Sogeti and OpenText.

\*All research carried out by Coleman Parkes Research is conducted in compliance with the Code of Conduct and guidelines set out by the MRS in the UK, as well as the legal obligations under the Data Protection Act 1998.



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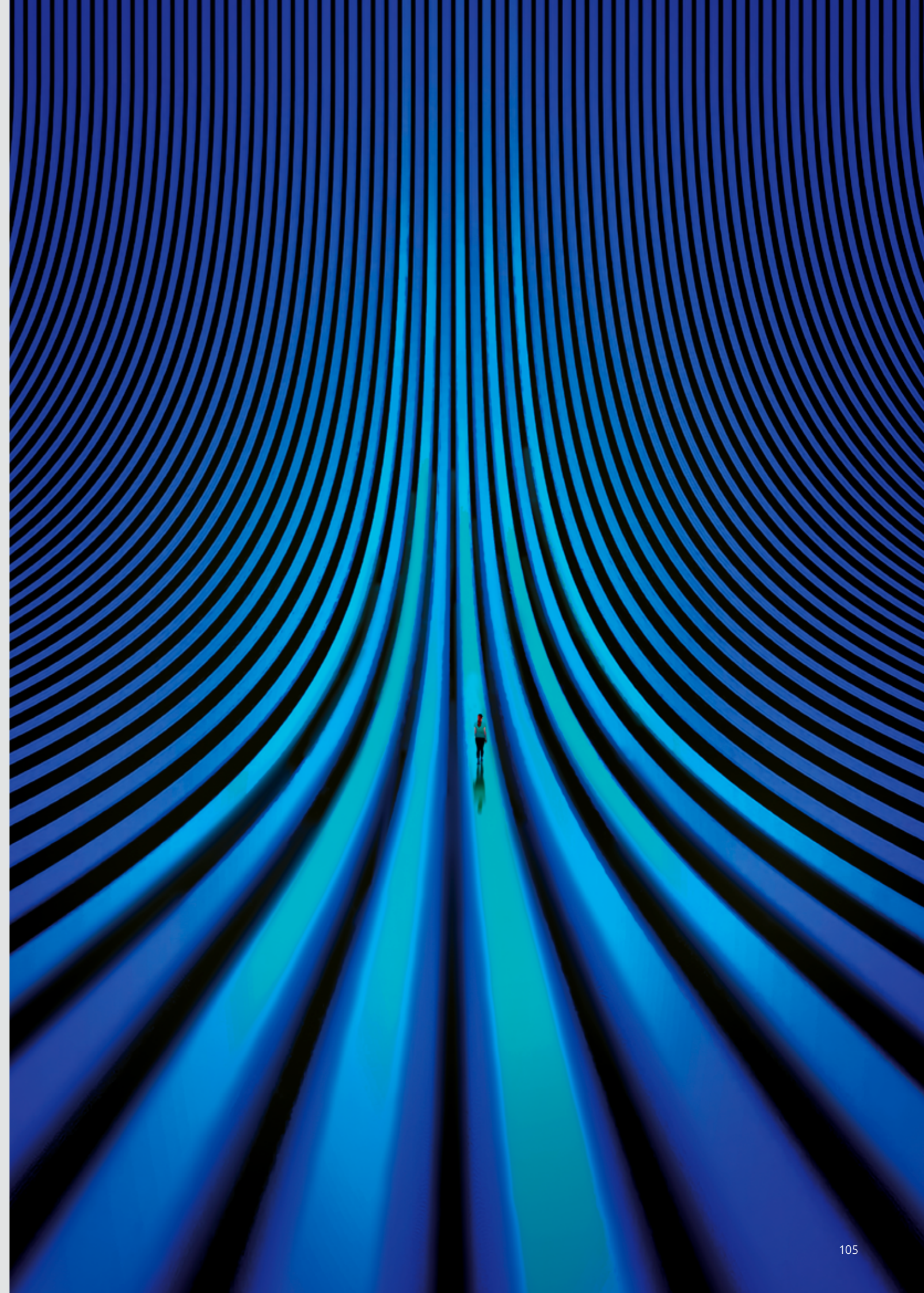
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