



White Paper

Continuous Testing Navigator for 2021



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Introduction



Coty Rosenblath

CTO at Katalon, Inc.

“ In the past few years, the quality assurance landscape and related testing approaches have witnessed a rapid and on-going transformation, proving Continuous Testing methodologies as an indispensable framework for teams of all sizes.

With the primary focus on identifying the essentiality of continuous testing methodologies, this whitepaper was thereby developed to delineate a concise and comprehensive overview of continuous testing trends, upcoming roadblocks that can be expected for enterprises looking to transition, and experts’ insights in achieving positive progress of continuous testing maturity.

Leveraging responses collected from a survey of over 2,000 IT professionals and practitioners across industries, we will take a deeper dive into how teams can assess their current stage of continuous testing adoption, thriving business outcomes grounded in today’s tried and tested practices from experts in effective team management and collaboration. ”

Executive Summary

These are the key findings and inferences that we derived from the data.

1. 2021's ever-changing Quality Assurance Landscape has put achieving "quality at speed" top of the list for every organization.

With the rapid emergence of shift-left testing, DevOps, Agile methodologies, and new technologies such as AI/ML, **80%** of QA teams have now applied CI/CD as an integral part of their Software Development Life Cycle (SDLC) and **70%** emphasized the need for "daily" or "weekly" release intervals.

2. Navigating your team to maturity with continuous testing.

The Continuous Testing Maturity Model is a foundational reference to provide teams with self-assessment guide, allowing you to identify your current stage of continuous testing maturity. Up to **two-thirds** of polled individuals said they were at the Defined level. This in which hints to a conclusive, and positive progress in adopting and utilizing continuous testing for teams in general.

3. Challenges faced across different stages of Continuous Testing implementation.

Regardless of the chosen approach, stumbling upon struggles and roadblocks along the adoption journey is to be surely expected. To support you, our experts have revealed their insights on proven techniques of test failures and bottlenecks investigation, improving test automation coverage, reducing test cycle time & mitigating quality risks, and standardizing and automating release processes.

4. Test orchestration: Giving structure to your Continuous Testing.

On top of bringing full visibility and monitoring progress across the entire CI/CD pipelines and SDLC with thorough test reports and insights, effective test orchestration could also speed up the release pace, provide instant feedback loops, and improve team collaboration with toolchain orchestration.

Part 1

2021's Ever-Changing Quality Assurance Landscape

The software industry keeps evolving constantly. What was considered cutting edge a few years back might no longer be relevant. Regardless of your role or the responsibility that you are taking in your testing time, understanding the top quality assurance landscape trends in the industry could be said to be imperative.

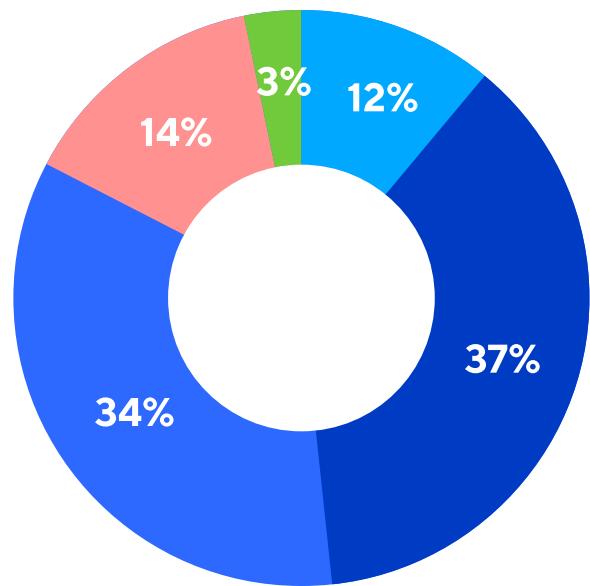
In **Part 1**, we will look at the key emerging trends, how organizations are shifting in this space, what is keeping them ahead of the competitive game and thriving in a digital transformation world.



1. Higher Standards of Customer Experience Quality

"The World Quality Report 2020-2021" (researched by Capgemini and Micro Focus) shows that testing isn't only about functionality anymore, but also ensuring that software products would be realistically experienced the way end-users will before releasing them to the market.

To perform the transition while still remaining satisfactory to meet businesses' needs, organizations now leverage **Agile/DevOps/Continuous testing** to curtail the time-to-market and deliver top-tier software quality with greater flexibility. From the QA teams that participated in the survey, more than **70%** reported having "daily" or "weekly" release intervals, putting the priority of speeding up their software development life cycles.



The frequency at which your team deploys new builds to production

- Hourly
- Daily
- Weekly
- Monthly
- More than 2 months

To reach these goals and enable frequent code deployments, test automation and continuous testing are integral parts of the QA process as it reduces the dependency on manual testing.

2. The Emergence of AI/ML Technologies

From Fortune Business Insights' AI Forecast 2020-2027 report, the AI market value is expected to see an 880% increase in value, at a Compound Annual Growth Rate (CAGR) of 33.2%, from \$30 billion USD (2020) to \$266.96 billion USD (2027).

Not only bringing the ability to provide fully autonomous test creation, **Artificial Intelligence or Machine Learning** (AI/ML) is forecasted to be extensively used in the development of test automation tools. Offering simplification to instances such as accuracy to page object identification and Document Object Model analysis, AI will be, as anticipated, ubiquitously present across all areas of technology.

3. Accelerating Momentum with Orchestration

Coordination is always needed in order to ensure efficiency and transparency throughout the SDLC. Having worked with projects and QA teams of all sizes, we have been able to narrow down on the two most common testing dilemmas – delivering quality at speed and maintaining coherence and effectiveness in team management and collaboration.

The drastic increase in projects of much larger scales has correspondingly raised the demand for **workflow orchestration** to centralize large volumes of test data across the entire pipeline. With this, QA teams also have stressed the need for coordination to ensure efficiency and transparency throughout the testing cycle.



4. Focusing on Smarter Testing: Doing More with Less

Enterprises are better at structuring their entire testing scope.

Diverting their focus **from defect detection to defect prevention** to meet business goals. Large corporations, including early-stage startups, are advancing towards frequent use of **DevOps** and **shift-left** practices to attain more continuous feedback in the product release.

Additionally, we have also seen the shift towards advanced test automation solutions to scale up testing processes and achieve higher return on investment, particularly with:

- **Test case prioritization** in helping teams to focus on critical issues and minimize the additional effort and costs associated with a large amount of regression testing
- **Self-healing and self-learning technologies** to reshape the means of quality validation, smart detection, and flaky test cases



► Key Takeaway

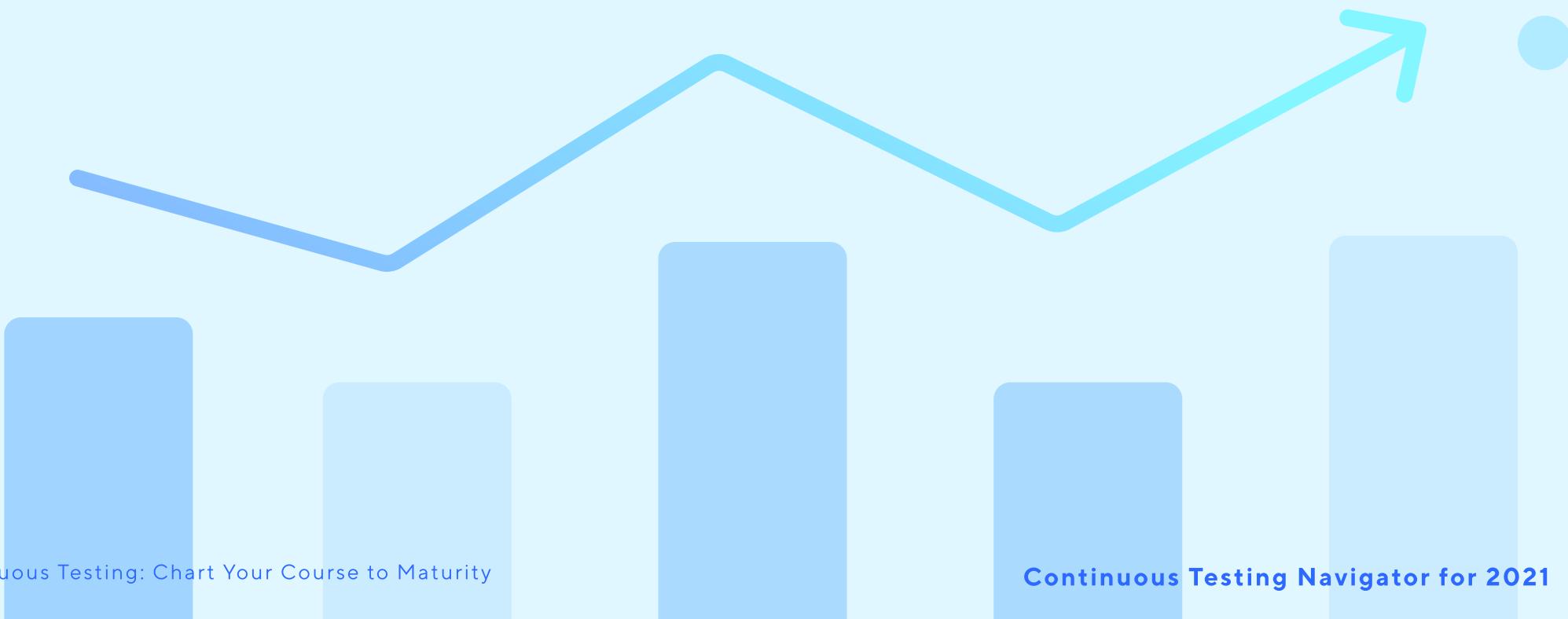
To make a difference among the pool of thriving competitors, every organization now has recognized the need to usher the more modern and agile approaches. Such efforts made consequently have provided a basis to why continuous testing is necessary, next-gen revolution and among the top key strategies for accelerating releases and simultaneous quality assurance.

However, its adoption sometimes can be complicated due to the lack of a proper road map and a strategic plan set out. As a result, not only would it hinder the ability to achieve thorough test coverage and efficiency, but also poses difficulties in maintaining more demanding requirements from stakeholders and customers.

Understanding the team's struggles with the continuous testing journey, the second part of this paper will introduce you to a newly-refined Continuous Testing Maturity Model.



Continuous Testing: Chart Your Course to Maturity



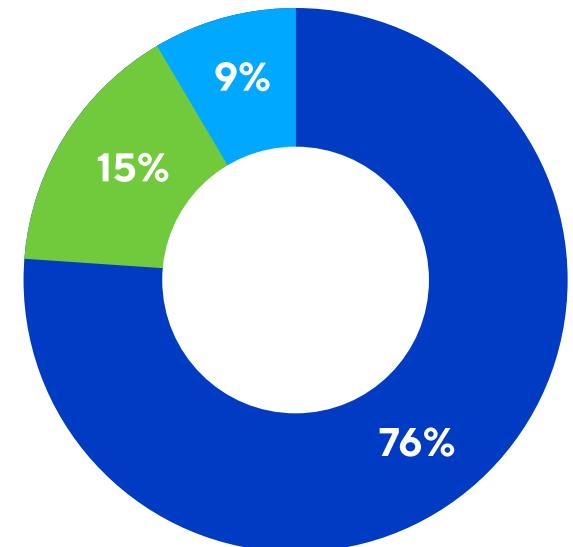
How Continuous Testing is Reshaping Quality Assurance in 2021

Continuous testing is a software testing process in which the product is evaluated early and frequently throughout the entire SDLC. Playing an integral part in the software delivery pipeline, continuous testing enables teams to receive rapid and early feedback, allowing thorough risk evaluation throughout the entire process.

As previously mentioned, the need for responsive development cycles was the determining factor for organizations to adopt DevOps and CI/CD cultures. While this can provide security through daily, or even hourly software updates, applying these approaches on their own would eventually trade-off the operation's speed. To avoid the possibility of slowing down, teams would need to incorporate automated continuous testing in order to:

- Eliminate the testing bottleneck in DevOps and CI/CD
- Provide useful, risk-based feedback
- Make more thought-out release decisions
- Enable collaborative teams and reduce working in silos
- Seamlessly integrate into the software delivery pipeline and DevOps toolchain
- Deliver actionable feedback appropriate for each stage of the delivery pipeline

Does your team apply CI/CD?

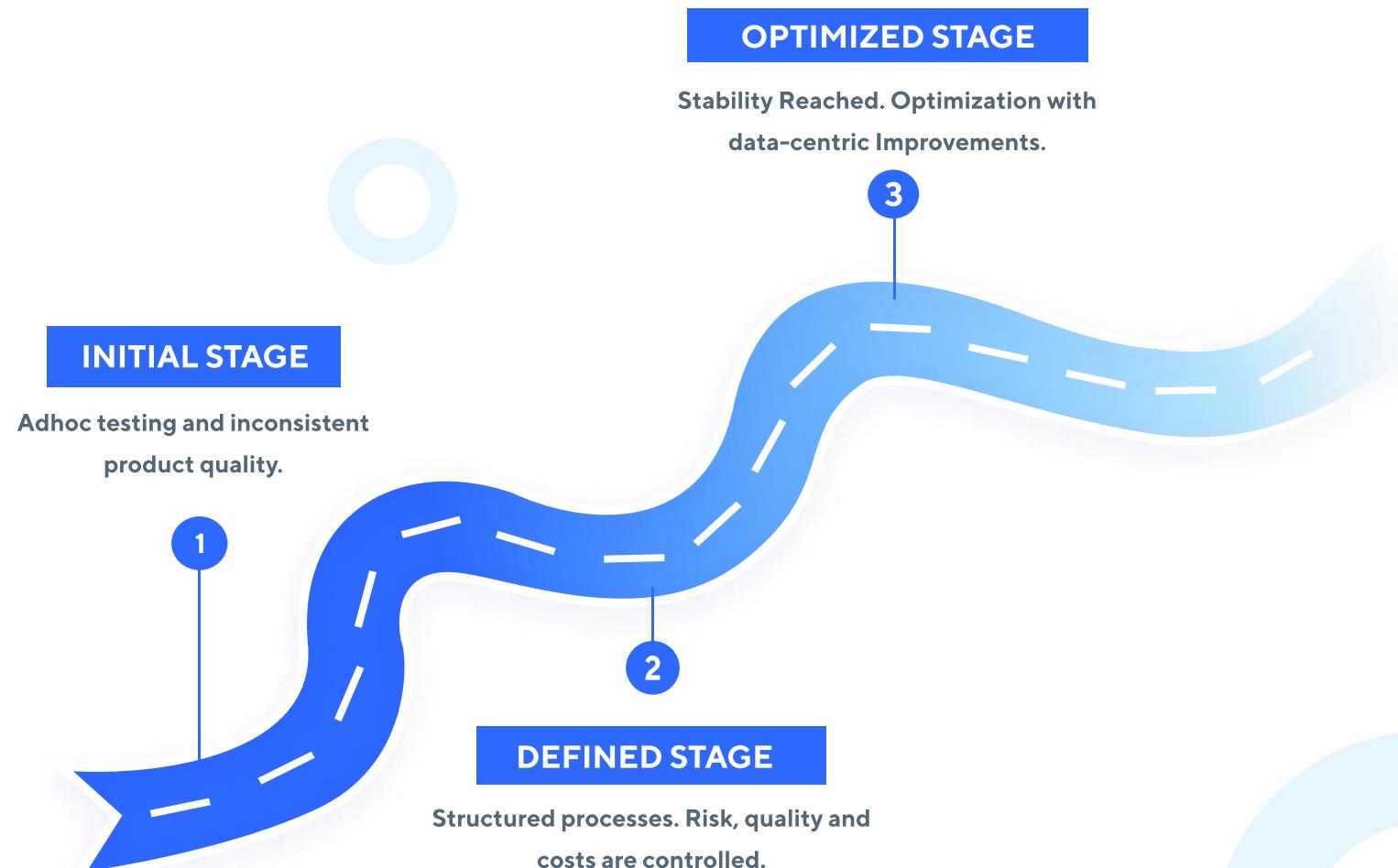


- Yes, we are applying CI
- No, it does not match our testing process
- Not now, we will apply it later

A Newly Defined Continuous Testing Maturity Model

To simply put, continuous testing isn't a one-time application. Rather, it's a long-lasting journey towards a more frequent and reliable automated release pipeline and stronger team orchestration between QA, development, and business teams.

This **Continuous Testing Maturity Model** serves the purpose of giving your team a reference for self-assessments and defining your progress on the automated continuous testing journey. The maturity levels are divided into 3 stages: **Initial**, **Defined**, and **Optimized**.



STAGE 1: INITIAL

Unpredictable processes and adhoc testing.

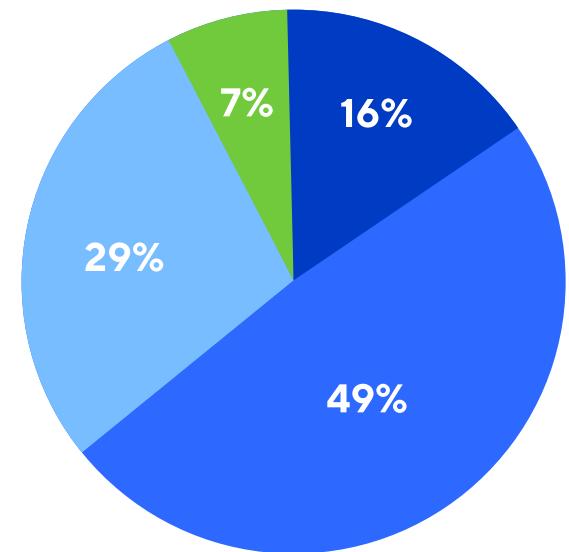
At the Initial stage, the key characteristic to distinguish this level from the others is that your QA team has already adopted CI/CD for your projects, however, there are still manual interventions and processes that are unstructured and loosely coupled to each other when it comes to source code management for triggering tests.

With the sole focus on having releases out on time and minimal defects or issues, this would, unfortunately, generate an unstable delivery in terms of the progress made and quality. Here, this could be explained by the limited or wide expertise gap in test automation skills and knowledge among members of a team.

To be more specific, your team would probably have just started building the process from scratch and have yet to make full use of continuous testing practices. In simpler terms, operations are still loosely coupled and your team would be likely to still plan and design everything right before the development teams start coding.

Without a proper plan set out, functions in your testing team would individually deliver the application to production and leave defects to only be detectable, rather than preventable as it would start late in the process. Furthermore, shift-left testing practices would likely not be incorporated or do not have a large contribution to your team's workflow in general.

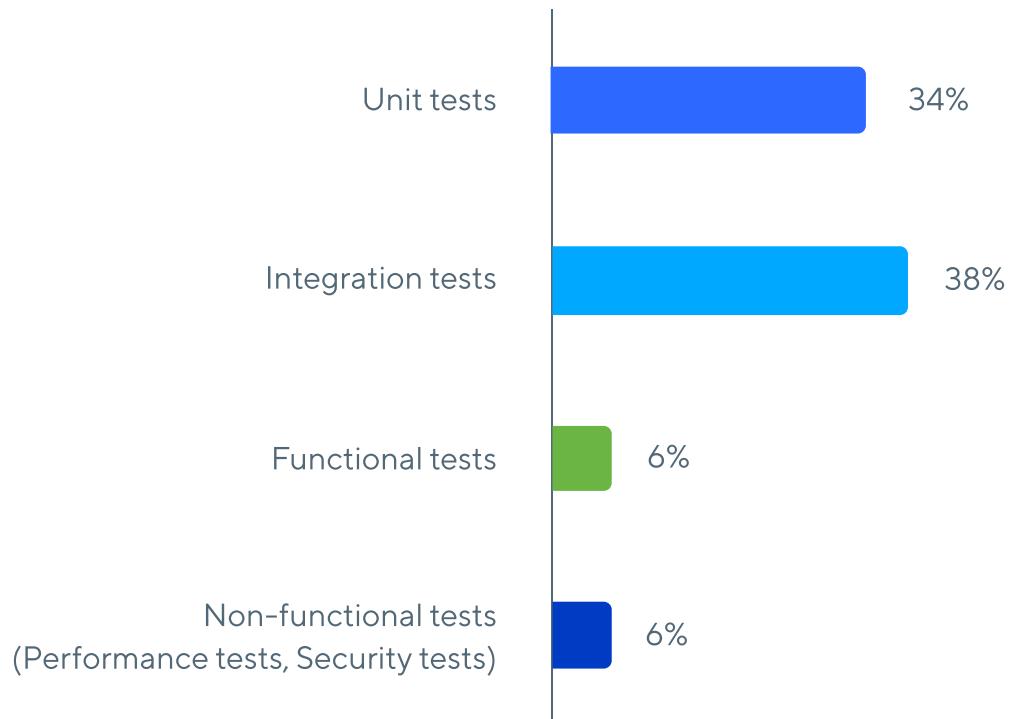
QA team size



- 1-5 members
- 6-10 members
- 11-20 members
- More than 20 members

From the survey, there are nearly one-third (27%) of respondents at the Initial stage. Where 65% stated that they are in small or medium-sized QA teams - consisting of 10 testers or less.

Type of tests that were automated by Initial-level teams

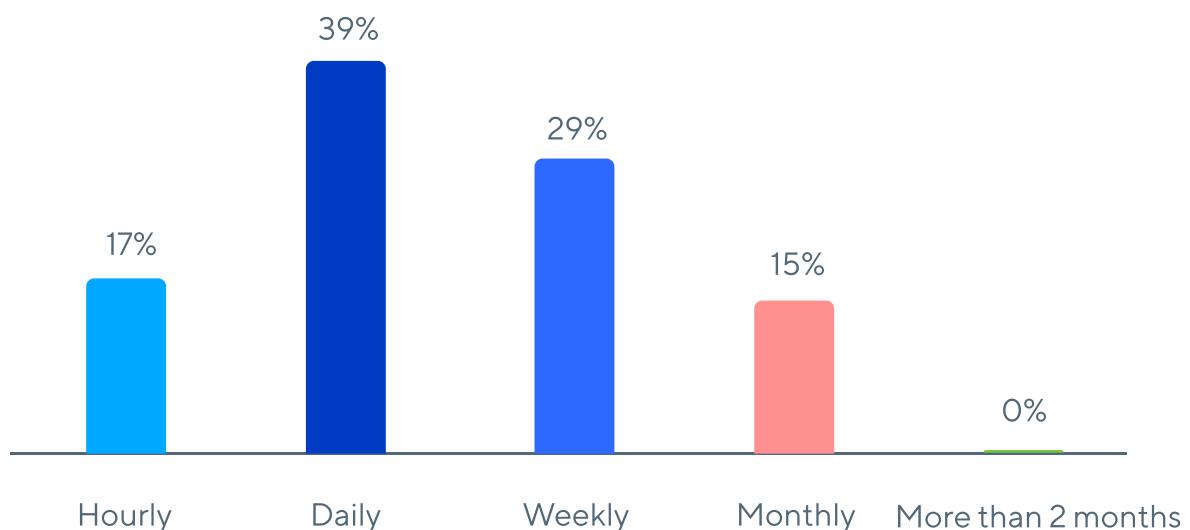


As shown, those that have been applying automation testing actually have **relatively low coverage** (all less than 50%) across different testing types. From this, it could be said that at this maturity level, automation is applied majorly to unit tests (34%) and integration tests (38%), while manual work functional (6%) and non-functional testing (6%) is still adequate in the quality assurance process for some teams.

When asked how often teams deploy new builds into production, “**daily**” was the top choice. In contrast to our previous expectation, the 2021's survey stated that the frequency of deploying new releases is not the key factor to determine a team's continuous testing maturity level.

This is because having speedy releases is no longer an expert's team story, but a norm for any team at any maturity level. Furthermore, the need for a faster delivery process could forecast a behaviour of shifting to a more agile approach for teams.

The frequency at which Initial-stage teams deploy new builds to production

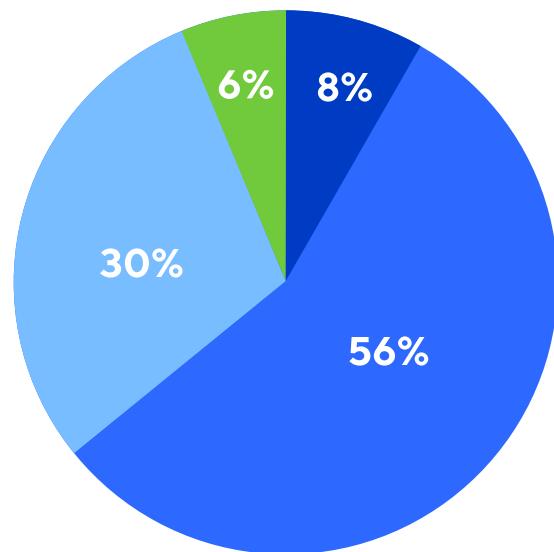


STAGE 2: DEFINED

Structured processes. Risk, quality and costs are controlled.

Unlike the Initial stage, every CI pipeline trigger is handled manually, putting more burden on developers as code frequently changes. Solving that problem, teams at the Defined stage would have more experience with automation, and thus are able to schedule and automatically trigger CI pipelines, with project-appropriate methods, at hourly, daily, or weekly intervals, without much manual intervention.

As a result, this difference would make the source code management process easier and faster, fostering better collaboration between developers and testers with on-the-job and team training to be possible.

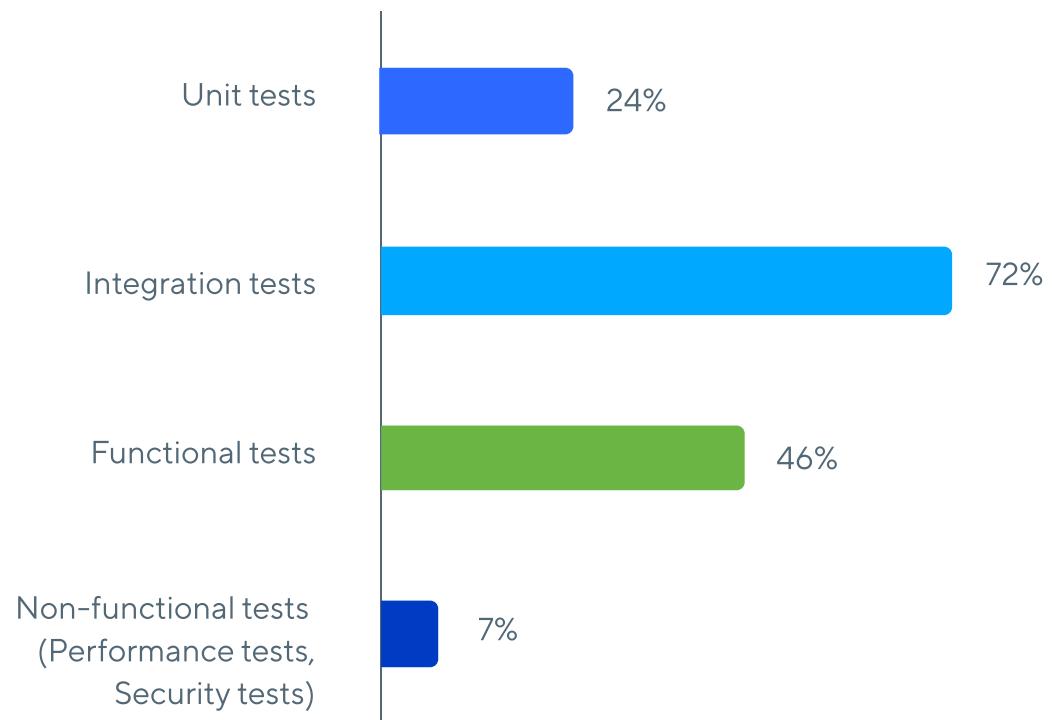


QA team size

- 1-5 members
- 6-10 members
- 11-20 members
- More than 20 members

With over half of the participants in medium-sized QA teams, at 5 to 10 members, and one-third in teams of 10 to 20 members, 43% have reported to be in the intermediate stage.

Types of tests that were automated



On top of that, the way that your team triggers automated tests at this stage would also differ. With the ability to trigger automated tests to run automatically via polling or scheduling, you and your team would be sure to have regression testing take place daily or twice a day, be rid of the mental overhead around triggering test runs, and testing can pick up issues without any manual interventions.

From the data collected, automation practices are prioritized for **integration (72%)** and **functional testing (46%)** to ensure that every component fits together correctly. In other words, at this level, the focus of your quality assurance would solely be on integration and functionality testing, yet still maintaining necessary efforts on unit testing.

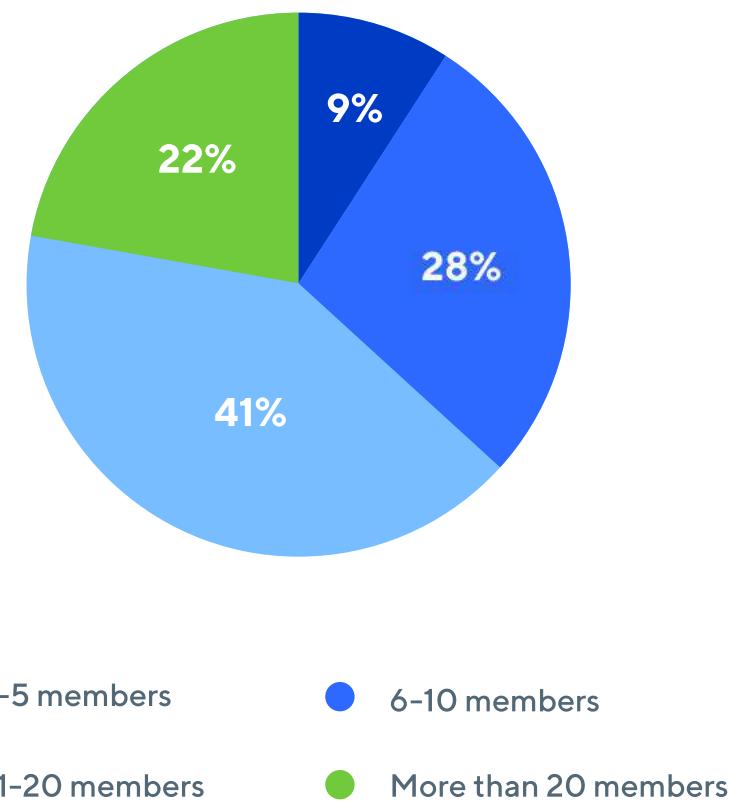
STAGE 3: OPTIMIZED

Stability Reached. Optimization with Data-centric Improvements.

If your team has reached the final level of maturity of continuous testing, automation has expanded beyond solving simple problems, and instead focuses on creating a more effective workflow. Having gained enough expertise on the subject matter, your team is now fully capable of constructing a plan with all the best-fit techniques and approaches after coming a long way of trial and error. With that, the ideal next step would be to utilize past results and measurements to well-tuned your overall testing process.

Specifically, your team's CI/CD pipeline is triggered through automation for every code that the developer has committed, and automatically deploys every change made in the codebase. Afterwards, environments are set up on the fly, unit tests are run, then API tests, followed by UI end-to-end tests. Each test cycle is automatically promoted to the next dependent on passing quality gates in the previous cycle. If all quality gates are passed, the code can be automatically deployed to production. Furthermore, through properly harnessing the capabilities of the continuous testing approach, it will in turn add efficiency and eliminate wait times, providing both visibility and metrics that deliver immediate feedback for continuous improvement.

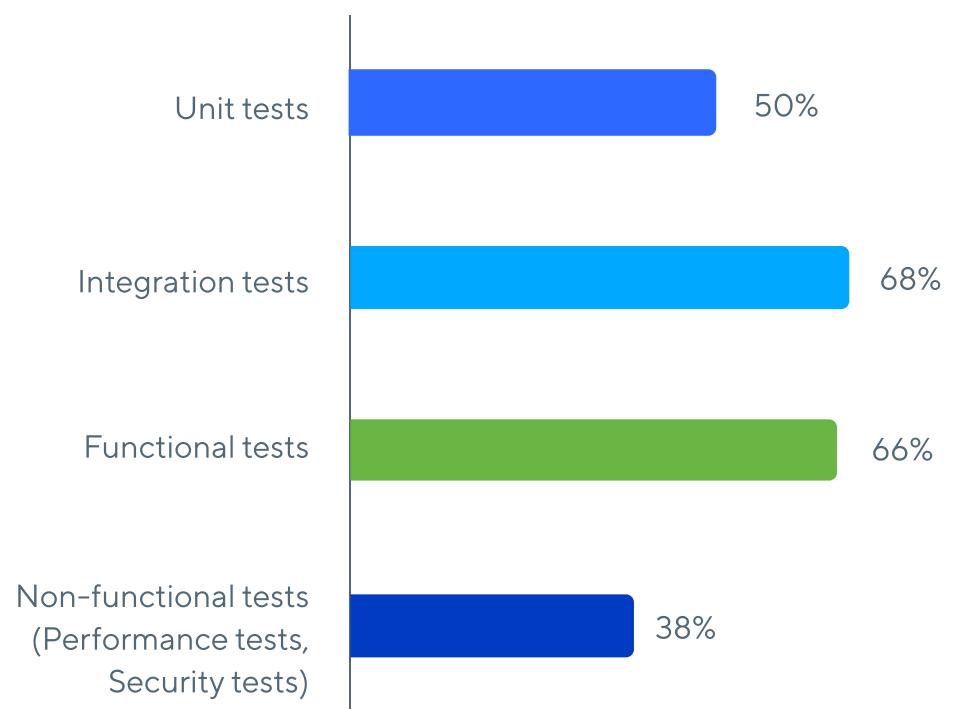
QA team size



- 1-5 members
- 6-10 members
- 11-20 members
- More than 20 members

With just over 30% of teams at this stage, with 91% in teams of 10 to 20 members, it could be concluded that there is a positive correlation between team size and maturity level.

Types of tests that were automated



Compared to teams at the other two levels, expert-staged teams put more emphasis on the presence of **non-functional testing** during their testing cycles. With more expertise and more flexible resources, functional testing is used for the purpose of ensuring that the software's functionalities work as expected, as well as non-functional testing to verify how well the application responds.

► Key Takeaway

Getting continuous testing right results in enhanced product quality, shortened time-to-market, and strong synergy among development, testing, and operations. Therefore, mapping your strengths and knowing the maturity level of your team on the continuous testing journey is vital to find gaps for improvement and witness growth.

Having completed this assessment, we hope to have given you a better understanding of where your team or organization stands at the moment, and on which areas to invest more or less effort into. From there, all there is left to do is identifying the next move or action that needs to be taken.

It is important to keep in mind that the reality is that the road to continuous testing maturity, at any stage, is never a straight line. These “stages” are full of success, failures, false starts and detours. In this *next part*, we will arm you with more insights to overcome setbacks and obstacles you may face on your journey ahead.

Bring Katalon on your journey?



Challenges in Applying Continuous Testing across Different Stages



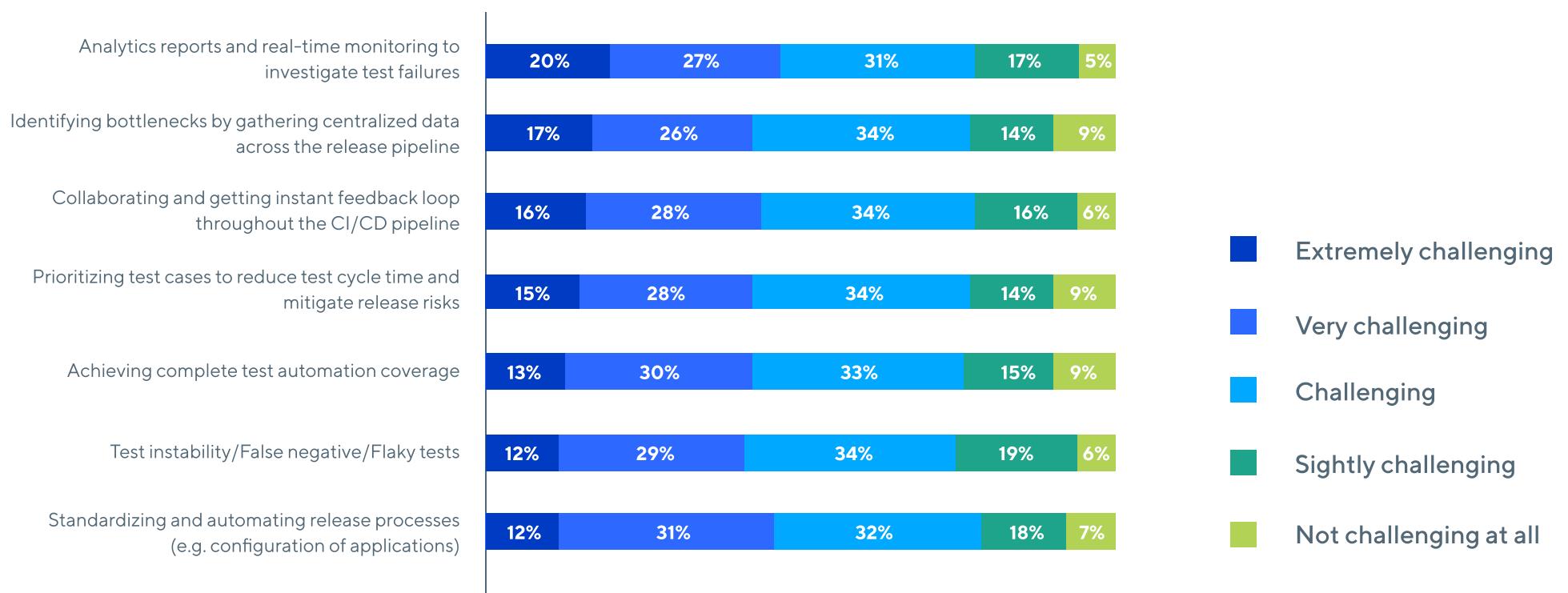
So, it cannot be denied that continuous testing is essential, however, making it happen is a challenge in any development environment for a number of reasons. In **Part 3**, we will reveal top challenges across different stages of continuous testing maturity. By understanding these roadblocks, your team can craft a suitable strategy to encounter and achieve the organization's goals of quality, speed, and efficiency.

Challenges for the Initials

We asked respondents at the Initial-stage teams about the challenges they face in applying continuous testing. It was surprising to find that the most common challenge (95% - from extremely challenging to challenging) was difficulty in **Analytics reports and real-time monitoring to investigate test failures**.

At this stage, teams have limitations in both tools and human effort to operate a test quality system that will provide such sufficient information as 91% of this group stated that identifying bottlenecks by **gathering centralized data across the release pipeline** was difficult, whereas 94% reported that **team collaboration and instant feedback loops** are their main problems in CI/CD pipelines.

The difficulty levels of the common challenges that your team faces throughout the testing process

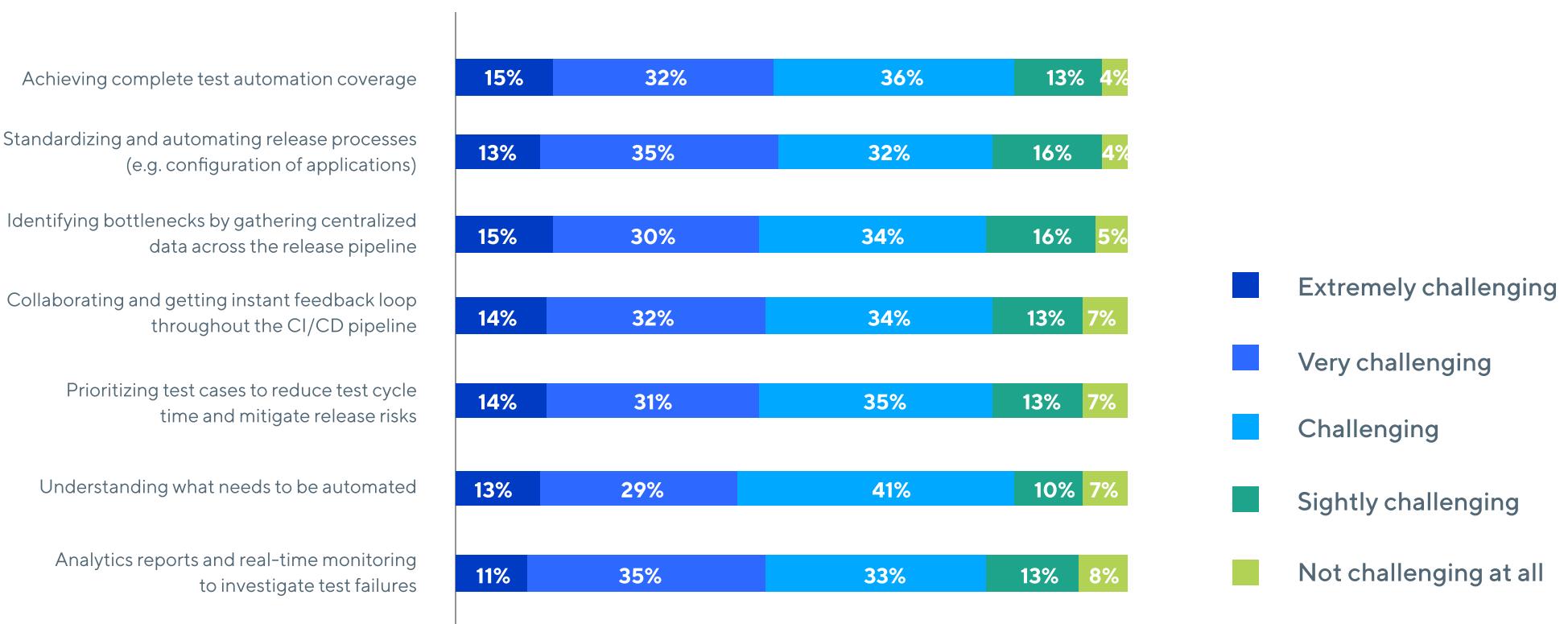


For the Defined-Stage Teams...

The top answers for the 3 common challenges of Intermediate-level QA teams are **achieving complete test automation coverage** (96%), **standardizing and automating the release processes**, and **the lack of centralized data to identify bottlenecks** – which hasn't gone away from the initial stage's challenge.

It is understandable that at this stage, test automation plays a significant role, with the potential for scalable and continued coverage.

The difficulty levels of the common challenges that your team faces throughout the testing process

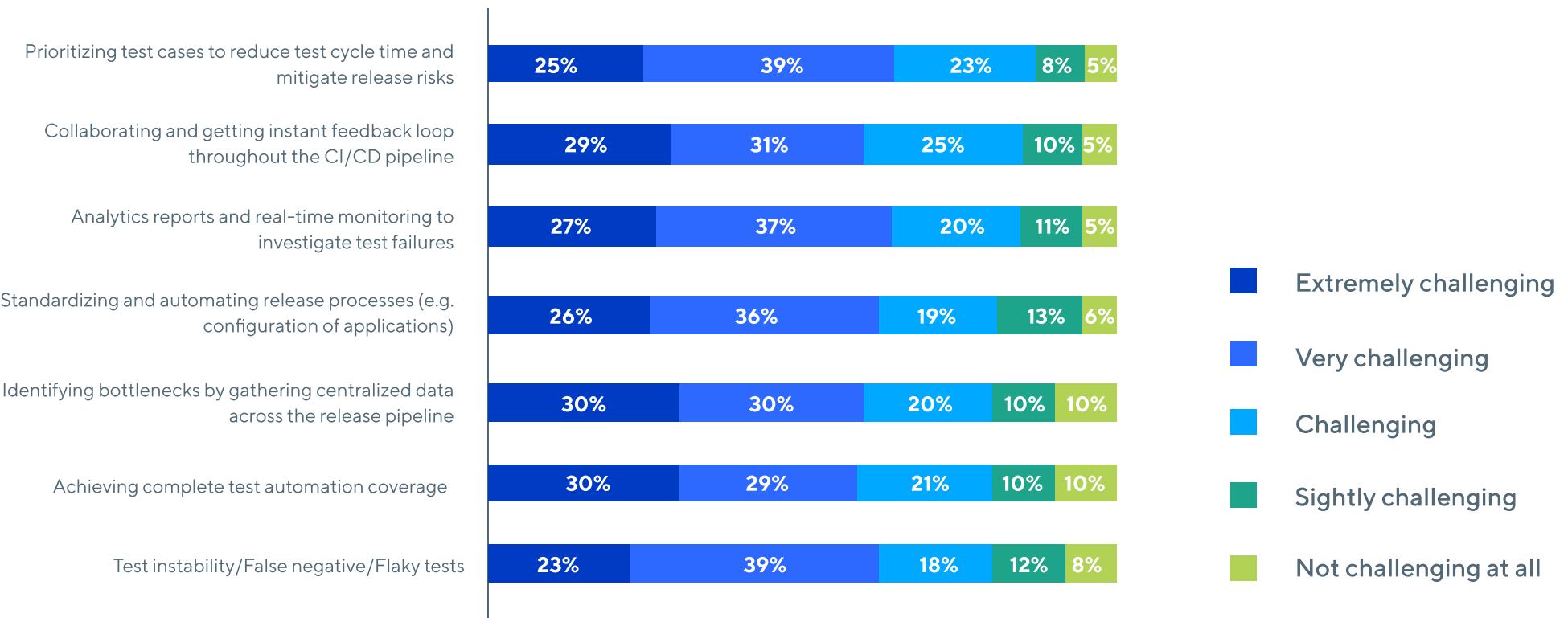


Problem for the Optimized-Stage Teams

We see that around **95%** of respondents stated that they were stuck with the **test case prioritization** technique, which if successfully implemented, will reduce tremendous test cycle time and release risks.

It's also reported that the frequently seen problems to them were **collaborating and getting instant feedback loop entire CI/CD pipeline** and **gathering analytics real-time reports for test failure investigation**.

The difficulty levels of the common challenges that your team faces throughout the testing process



► Key Takeaway

In general, it's heartening to note that, while these challenges have been many, there are signs that teams are taking advantage of the upheaval to improve their performance, with greater shared commitment and greater determination to succeed. Using the right continuous testing tool is also incredibly beneficial to your overall testing and delivery success. We compiled a list of 10 most popular continuous testing tools in the market for your reference [here](#).

Addressing these problems is far from straightforward. It requires an organization to undertake a long, well-planned journey. The good news is that we see several organizations ready with a roadmap, and making steady progress. In the *next part*, one among those key solutions will be revealed!



Test Orchestration: Giving Structure to Your Continuous Testing

As mentioned in the previous part, the adoption of continuous testing is steadily increasing, but there are still challenges that may hinder the maturity across organizations. In this part, we've compiled our expert's advice to give you guidance, which is believed to result in a better collaborative QA team with more standardized processes and test orchestration tools.

Given the fact that there is no such thing as a one-size-fits-all solution to remove these above roadblocks. Every business looking for the right solutions should take a holistic approach, understand the constraints in their current software delivery process with an eye to their short and long-term goals.

For further information, visit www.katalon.com/testops/

Test Orchestration Capabilities to Solve Common Challenges across Teams

Test orchestration, as its name, is the process of scheduling a series of automated tests in a predefined sequence, to make sure that it can be controlled and optimized at ease. If test automation just focuses on handling a single task, test orchestration looks at the bigger picture, streamlining the testing cycles to reach a more efficiency level.

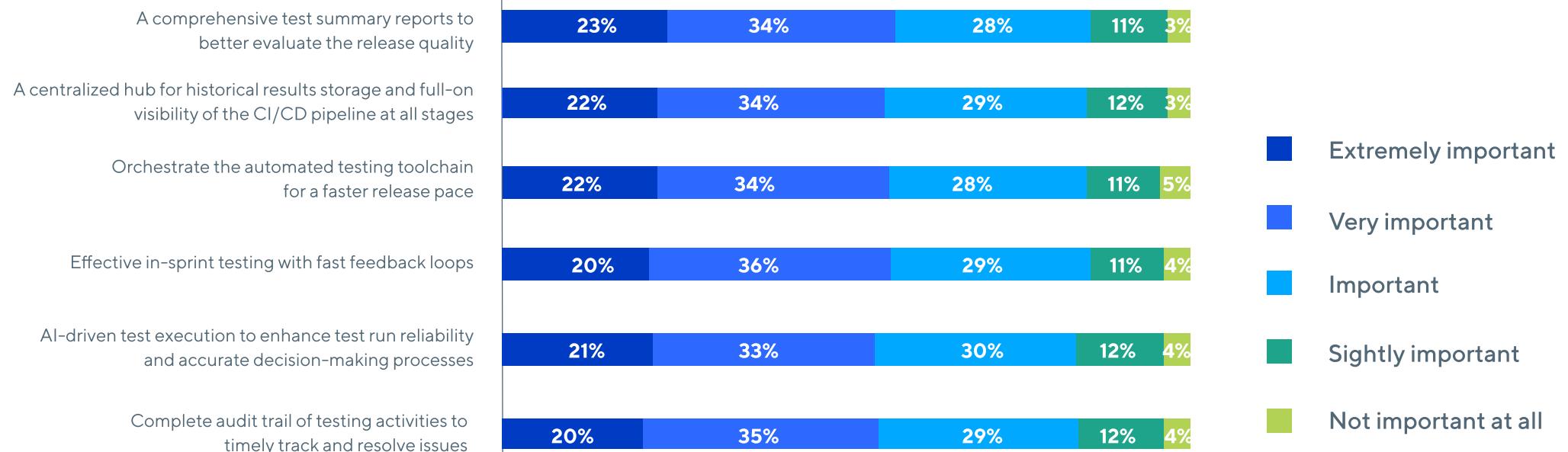
When asked about the solutions to accelerate the continuous testing process, **97%** of respondents gave the highest weight to:

- Test summary reports for release readiness evaluation
- A centralized hub for historical results storage and full-on visibility across all stages
- Orchestrate the automated testing toolchain for a faster release pace

All three of these choices reflect the importance placed on the flow of information across the testing toolchain.

With the **right test orchestration platform**, teams can perform projects with customized real-time dashboards for transparency, combining test cases across different frameworks and environments.

The importance of CI/CD process-maximization solutions



► Key Takeaway

Among the best solutions for teams to better thrive, test orchestration is a practical method providing cost reduction, better connections, and workflow optimization for all teams at any maturity level. In general, some of the key elements organizations are shooting for through test orchestration is based on the following elements:

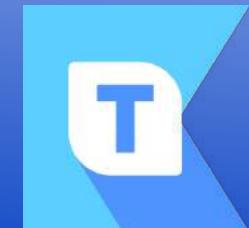
- Comprehensive test summary reports and dashboards across all CI/CD pipelines
- Centralized hub for historical data with full visibility of the quality of the entire SDLC
- Toolchain orchestration for better collaboration and faster release pace
- Effective in-sprint testing with the instant feedback loop
- AI and ML technologies to continuously and automatically optimize test suites
- Complete audit trail of testing activities for timely tracking and monitoring.

Katalon TestOps is the first comprehensive platform with test execution, team collaboration, and project management capabilities. With it, your team now can seamlessly have a centralized testing ecosystem, with the orchestration ability for intensive control across your entire continuous testing processes. [Try it for free!](#)

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Appendix



Methodology

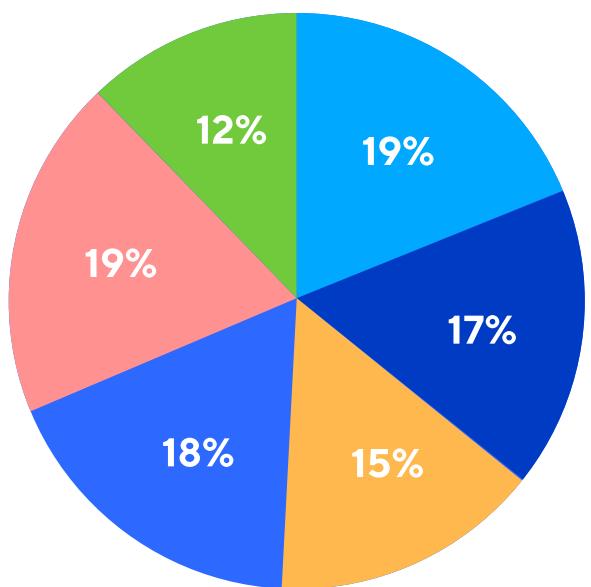
The findings from this report are based on our survey of **2,000+** respondents with different professional titles working in various industries. The survey consists of 13 questions focusing on the participants' experience with test automation in the context of their teams and organizations. Our survey is distributed via various channels with the support of the global software testing community.

Please note that Katalon does not describe this as a scientific study. All data and findings are compiled and concluded based on various responses from the communities. The percentages in this report were rounded to the nearest whole number for the analysis.



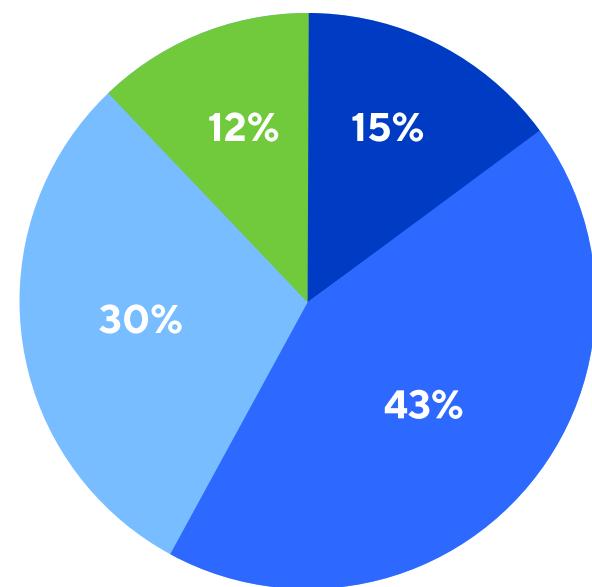
Respondents' Background Information

Professional role



- Automation QA Engineer
- Manual QA Engineer
- Software Engineer
- IT Engineer/Analyst/Consultant
- QA Lead/Project Manager
- Director/VP/CTO

Testing team size



- 1-5 members
- 5-10 members
- 10-20 members
- More than 20 members

About us

Katalon is a leading provider in software test automation solutions. The company offers a flexible platform for web, API, mobile, and desktop testing that fits teams and projects of any size, for any purpose – from creating tests, execution, and reports to seamless integration with the CI/CD ecosystem.

Our product:



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