

# The most striking problems in test automation: A survey

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# Executive Summary

Test automation is an essential part of modern software development lifecycles with Agile and DevOps. However, it accounts for a small percentage of test activities performed by software testing community. There are certainly challenges being faced by the community. So, understanding them is an important step to better adopt test automation in organizations.

We carried out a study surveying over 2,000 software professionals about the challenges and problems faced in applying test automation. Of over 100 automation tools being used, open-source and free ones like Selenium and Katalon Studio are dominant. Functional and regression testing are the most common types adopting automation.

The survey identifies the most striking challenges in applying test automation perceived by professionals with the top two being the frequently changing requirements and the lack of experienced automation resources. As implementing test automation strategies usually involves multiple tools, the difficulty in tool integration is also cited as a top challenge.

The survey shows that the cost of commercial tools is the top concern when it comes to the challenges or problems with the existing automation tools. When the application under test changes, test scripts generated and maintained by tools are broken, which is the second highest challenge. The reliability of automation tools is not a key concern for many respondents.

# Introduction

Software development approaches have evolved over the years to address the current existing trends of rapid changes in requirements and ever-shortening development lifecycles. Agile methodologies and DevOps practices are the now dominant practices for organizations to cope with such trends. In this world of Agile and DevOps, automation is widely accepted as a unique solution for teams to improve the productivity of testing activities, shorten time to deliver, and enhance the quality of software. Automation is believed to be essential for successful adoption of Agile and DevOps in software organizations.

Unfortunately, automation accounts for less than 20% of testing activities in software teams, according to the World Quality Report 2017 – 2018 [1]. Automation is responsible for only certain parts of the testing process in many organizations. It is often applied to generate test cases and execute regression tests rather than being deployed as a fully integrated part of the DevOps and continuous integration/continuous delivery (CI/CD) toolchain. Thus, automation is obviously under-exploited in the current state of software testing.

The software testing community has identified a number of challenges that hinder the adoption of test automation in organizations. One widely cited challenge is concerned with deciding the right set of automation tools. There are diverse testing needs that no one single tool is good and comprehensive enough to meet while various automation tools do not often work together. Another challenge is concerned with determining a right automation strategy to guide the testing team on when, what, and how automation is performed. Setting a right automation strategy can help the team to fully realize the benefit of test automation.

The objective of this survey is to better understand and offer concrete evidence on the most striking challenges or problems being faced by test professionals and their organizations. Such evidence can serve as a basis for relevant strategies to cope with challenges when an organization adopts test automation.

# Survey Overview

The survey's questionnaire consists of 7 questions asking respondents about their roles, experience with automation, automation tools used, types of testing applying automation, overall challenges faced with automation, and challenges in using the existing test automation tools. The survey was posted on several software testing websites and shared via several mailing lists including that of Katalon Studio's. The survey was run from March to April 2018.

We received answers from 2,291 respondents who had different responsibilities in their current organizations. About forty-one percent or 944 respondents were manual testers at the time of survey (they may have played other roles including that of automation testers). Almost the same percentage, 41.6% or 953 respondents, were test automation engineers or experts. Almost 9% of respondents were project managers, senior managers, or test managers who performed management and leadership activities for their respective projects and organizations.

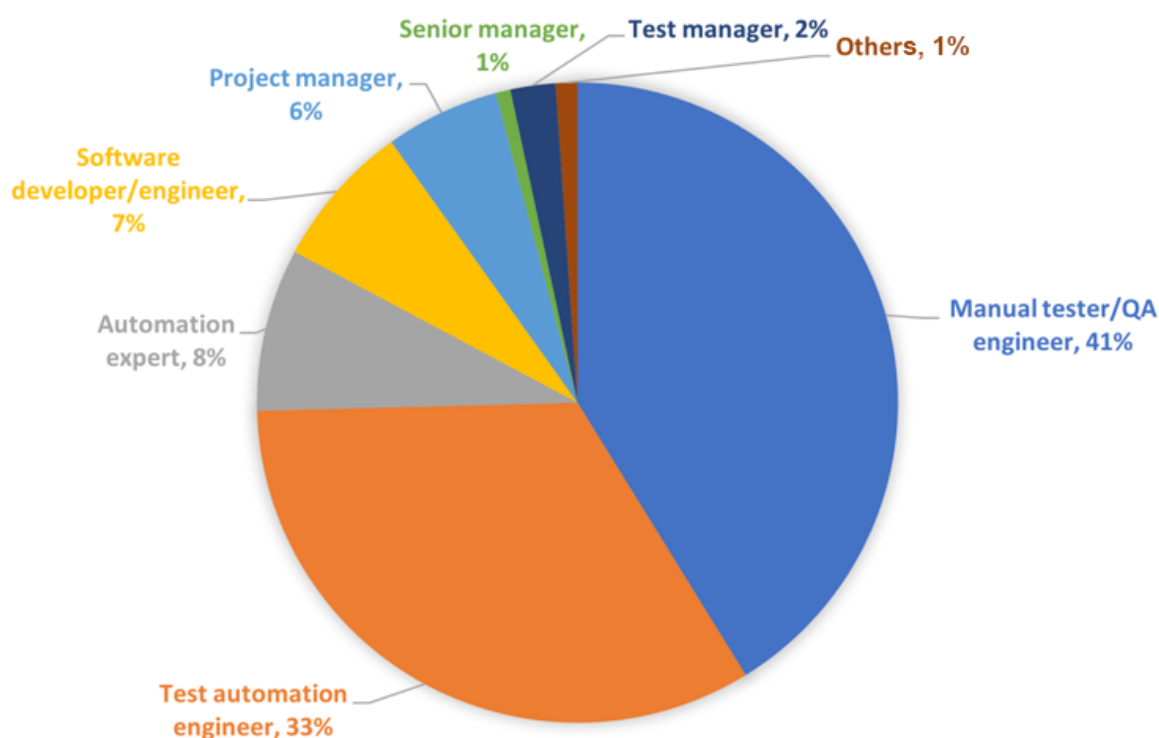


Figure 1. Current roles respondents play in their organizations

Of 2,291 respondents, 1,877 or about 82% have ever applied test automation to their projects as shown in Figure 2. Of all respondents, 970 (or 42%) and 484 (21%) have at least one and more than three years of experience (YoE) in test automation, respectively. More than two-thirds of automation engineers and experts (69%) and more than half of managers (52%) have at least 1 year of experience in automation.

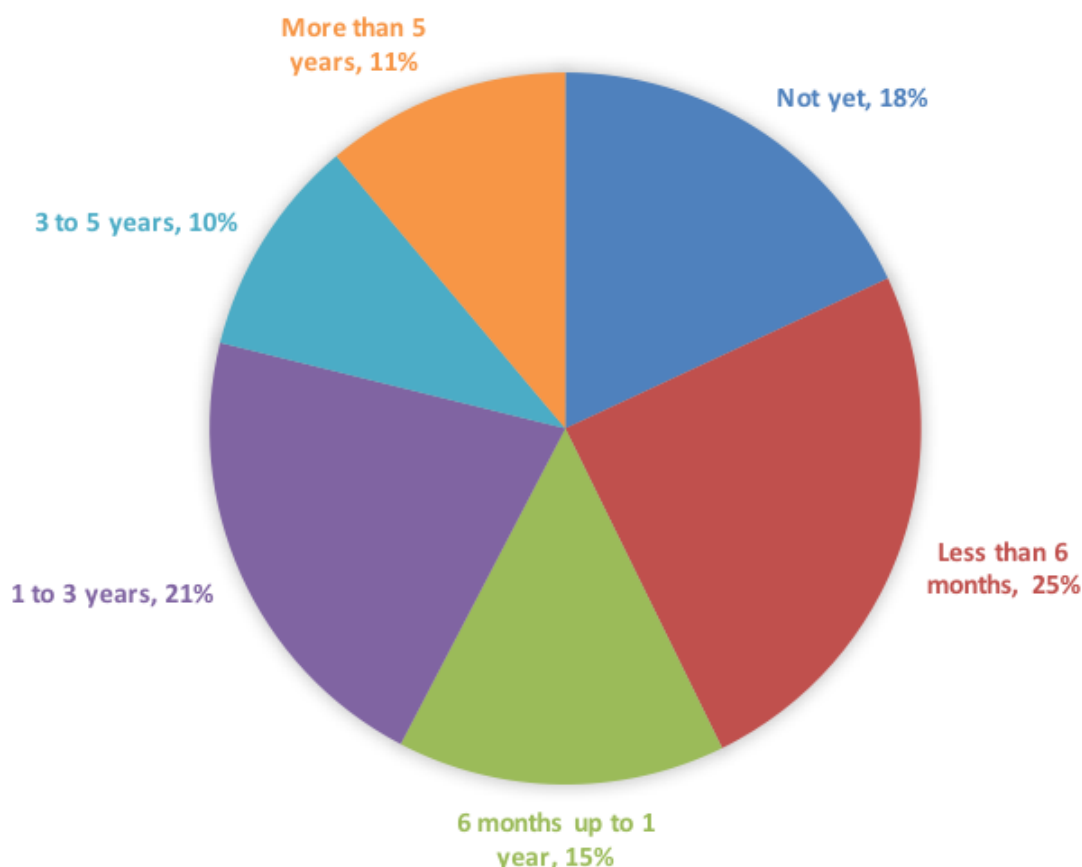


Figure 2. Respondents' experience in test automation

Over 100 test automation tools were used by respondents for their projects. Many of them have been using more than one tool. The overwhelming majority of respondents used Selenium (86%) with Katalon Studio being the second most popular tool as 39% of them ever used. It is worth noting that the survey was distributed via several websites and Katalon Studio's mailing list, and thus, the audience on these venues tend to be familiar with open-source and free test automation solutions like Selenium and Katalon Studio. Still, many respondents used commercial tools including UTF (16%), TestComplete (7%), IBM Rational Functional Tester (5%), Ranorex (5%), Telerik's Test Studio (4%), and Tricentis Tosca (3%).

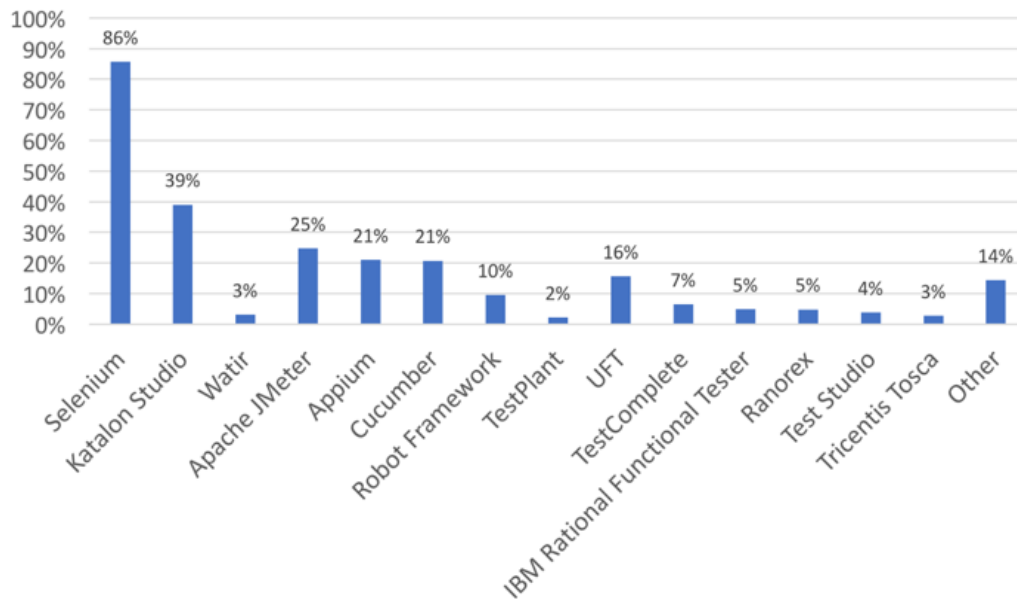


Figure 3. Automation tools/frameworks used by respondents

As shown in Figure 4, functional testing and regression testing are the most common types of test for which respondents applied automation with respective 84% and 72% of respondents saying so. Other types of testing are far less common, including smoke testing (40%), user interface/usability (37%), and API testing (35%).

Despite the mobile app popularity, it is quite surprising to find that the level of automation for mobile apps is low with only 25% of respondents saying that they applied automation for mobile testing.

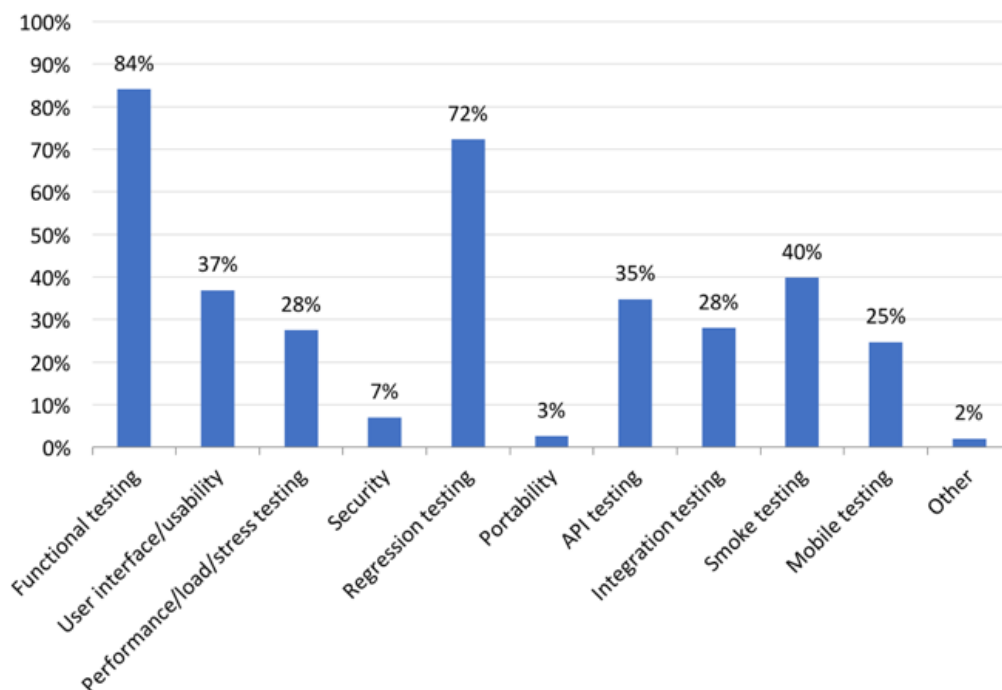


Figure 4. Testing types applying automation

# Overall challenges in test automation

Figure 5 shows the items rated by all respondents as the possible challenges faced when adopting test automation in their projects/organizations. The items are ranked by their weighted averages using a five-level scale ranging from “strongly disagree” as 1 to “strongly agree” as 5.

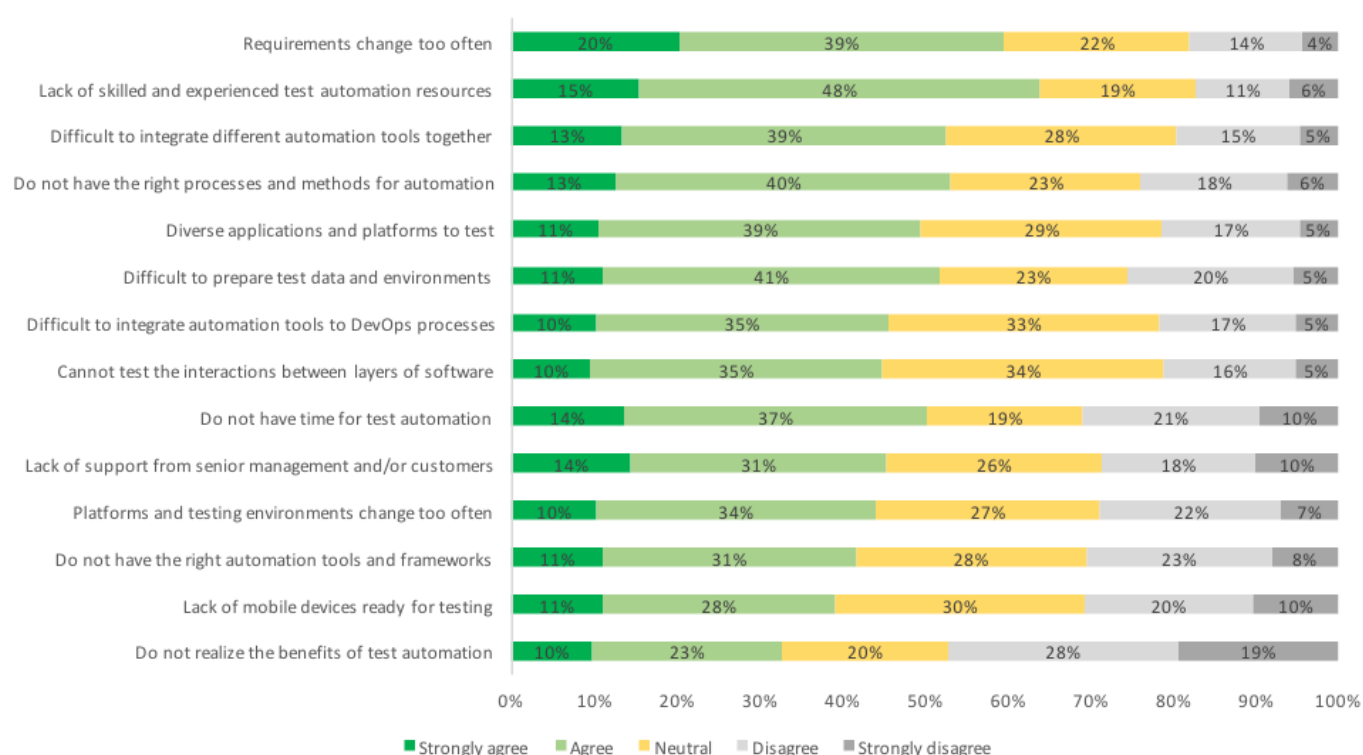


Figure 5. Overall challenges faced in applying test automation in respondents' projects/organizations

It is widely known in test automation that maintaining test scripts is a time-consuming activity to make sure that they are still functional when the requirements are changing. This survey confirms that rapid changing in requirements is the top challenge in test automation identified by 59% of all respondents (20% strongly agreed and 39% agreed). This is a possible reason explaining the high percentage of respondents reported in this survey (72%) opting for applying automation for regression testing when the feature to be tested is usually stable.



The lack of skilled and experienced automation resources is the second most cited challenge, by 63% of those surveyed. This finding is consistent with the World Quality Report 2017 – 2018 [1] in which the lack of professional expertise is also identified as a top challenge faced in applying test automation to agile projects. Although many automation tools provide advanced and user-friendly interfaces and features that are easy to use, experienced automation testers are necessary to implement automation effectively.

Other three challenges filling the top five include the difficulty to integrate different automation tools, lack of the right processes and methods, and the diverse applications and platforms to test. The 5th challenge is also cited as the second highest challenge in implementing automation by the World Quality Report 2017 – 2018 [1].

Realizing the benefits of test automation is ranked the lowest, suggesting that it is not a major concern for professionals to understand and realize test automation benefits to their organizations. The respondents ranked low for not having the right automation tools and frameworks, showing that they believed in their tools to be the right ones.

# Respondents with 1+ YoE in automation had a different view on challenges

The figure below shows the challenges ranked by managers (project managers, senior managers, and test managers) and non-managers who have at least one YoE in automation. The rankings by these respondents are quite similar to those of all respondents except a few differences. Rapid changing in requirements and the lack of skilled and experienced resources are still the top two challenges rated. But those with 1+ YoE valued the preparation of test data and environments over the other remaining challenges including the lack of right processes and methods for automation (which is not ranked high compared with other challenges).

Both non-managers and managers agreed on the same set of top five challenges, but managers tend to value these challenges higher than non-managers. About 61% of managers agreed or strongly agreed that rapidly changing requirements posed a real challenge for automation.

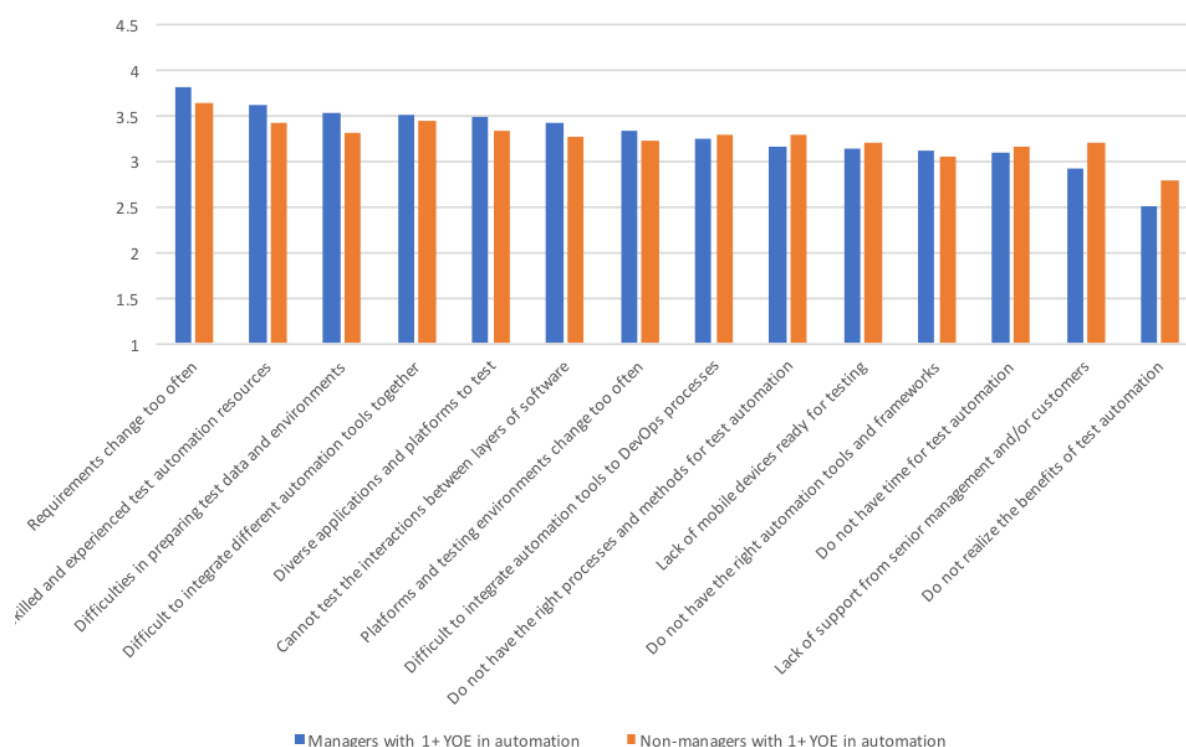


Figure 6. Overall challenges in automation rated by managers and non-managers with 1+YoE in automation

# Challenges and problems with the existing automation tools

A right set of automation tools is necessary for successful test automation adoption. It allows organizations to successfully implement testing strategies and realize the full benefit of test automation. To understand professionals' perceptions about the existing test automation toolset that they have, in the questionnaire, we asked respondents about challenges or problems that they had with the existing test automation toolsets used in their projects and organizations.

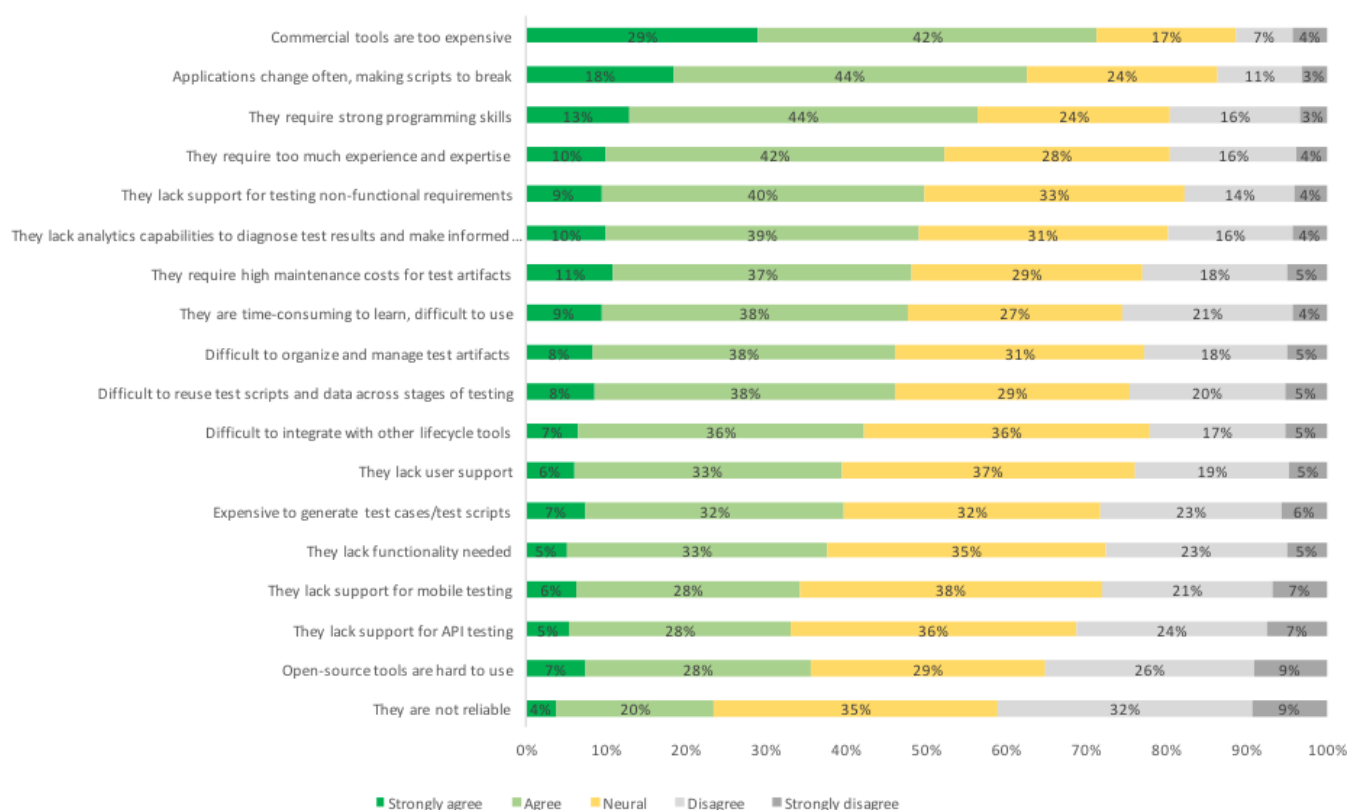


Figure 7. Problems with the existing test automation tools

The top problem agreed by 71% of all respondents is that the existing commercial tools are too expensive. It is a major investment to own good automation tools with the cost coming either in forms of resources for building automation frameworks or expenses to acquire

commercial solutions. Open-source tools are free to acquire, but they often require expertise to deploy and build. On the other hand, commercial tools often offer a comprehensive feature set along with dedicated support services to meet automation needs. But they often require high licensing and support costs that may not be affordable by small teams. Perhaps for this reason, a small percentage of respondents used commercial tools as shown in this survey.

The next top problem is concerned with the existing tools' generated test scripts too vulnerable to changes in the application under test (AUT). About 62% of all respondents agreed that, as the AUT changes often, test scripts are broken. This problem requires teams to maintain scripts, which is usually very costly.

The third and fourth highest challenges are related to high levels of programming skills, experience, and expertise needed to apply the existing automation solutions. Meanwhile, many respondents did not find it hard to use open-source tools as they rated the difficulty to use open-source tools the lowest. These results suggest that it is challenging to apply test automation tools effectively than to use them.

The fifth problem is that the existing tools lack capabilities to support testing non-functional requirements such as usability, safety, and security. This is a possible factor for the low level of automation adoption for these types of test.

# Lack of analytics capabilities and difficulty to reuse test scripts and data

Respondents with 1+ YoE in automation evaluated differently for the top challenges/problems with the existing tools from all respondents as shown in Figure 8. Although identifying the same top three challenges, they ranked the lack of analytics capabilities to diagnose test results and the difficulty to reuse test scripts and data among the top five, representing quite a different view compared with all respondents. This finding reflects that fact that few automation solutions now can address these problems.

As shown in Figure 8, managers and non-managers have a quite different view as managers had a higher level of consensus on the challenges than did non-managers. Managers were more concerned with the tools' level of programming skills required than were non-managers. More non-managers agreed that the lack of support for testing non-functional requirements is a challenge than they did for test script reuse, which is highly ranked by managers. It is worth differentiating the perspectives of these two roles, as managers tend to be concerned with a high-level perspective such as cost, support and maintenance services while non-managers are more concerned with learning, documentation, functionality of the tools.

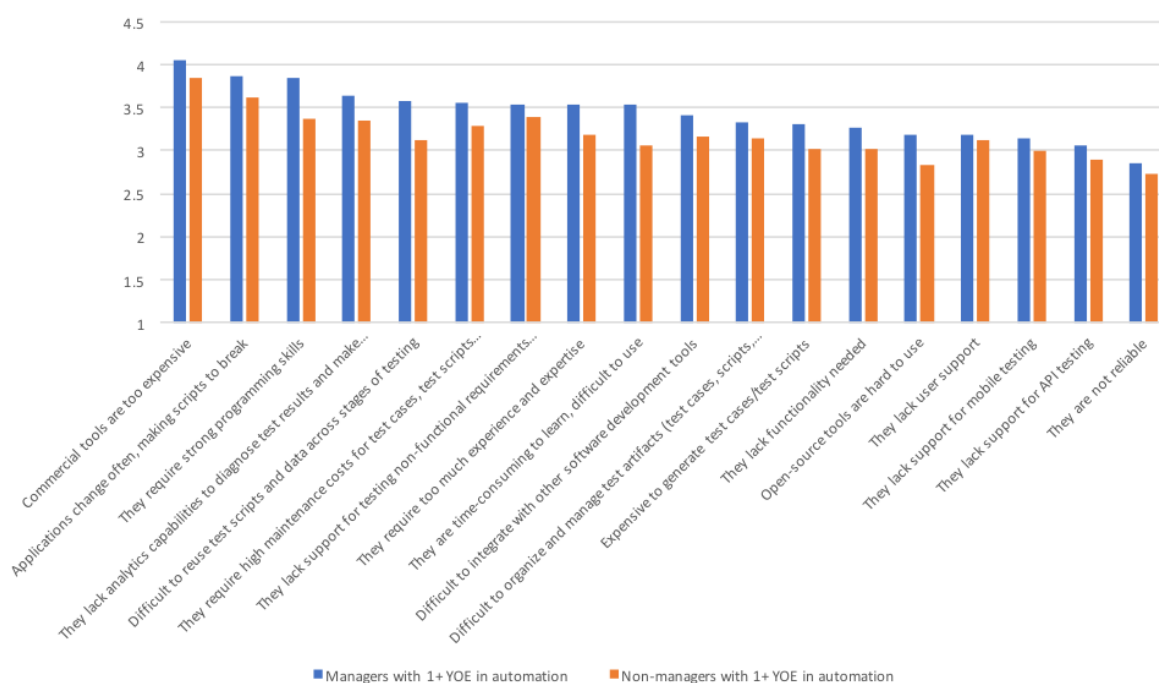


Figure 8. Challenges with the existing tools viewed by respondents with 1+ YoE in automation

# Summary

This article reports our study surveying more than 2,000 software professionals about their experience with test automation. The survey shows that open-source and free tools are dominant among over 100 hundred tools being used. It also provides evidence to confirm that most professionals apply test automation for functional and regression testing.

Too frequently changing requirements and the lack of experienced automation resources are identified as the most striking problems in applying automation. Regarding the existing automation tools, many respondents agreed that commercial tools are too expensive and test scripts are easily broken when the application under test changes.

The findings suggest that a holistic approach to automation, which includes the right resources, tools, and processes to cope with changing requirements, is needed to adopt test automation successfully.

# Reference

[1] The World Quality Report, 2017-2018, Ninth Edition.

# Appendix: Survey questionnaire

1. **Your roles on your current team/organization (multiple choice)**
  - a. Manual tester/QA engineer
  - b. Test automation engineer
  - c. Automation expert
  - d. Software developer/engineer
  - e. Project manager
  - f. Others (please enter)
  
2. **How long have you applied test automation?**
  - a. Not yet
  - b. Less than 6 months
  - c. 6 months up to 1 year
  - d. 1 to 3 years
  - e. 3 to 5 years
  - f. More than 5 years
  
3. **Which automation tools/frameworks have you ever used? (multiple choice)**
  - a. Selenium
  - b. Katalon Studio
  - c. Watir
  - d. Apache JMeter
  - e. Appium
  - f. Cucumber
  - g. Robot Framework
  - h. TestPlant
  - i. UFT
  - j. TestComplete
  - k. IBM Rational Functional Tester
  - l. Ranorex
  - m. Test Studio
  - n. Tricentis Tosca
  - o. Others (please enter)

4. Which kind of testing do you apply test automation for? (multiple choice)
- a. Functional testing
  - b. User interface/usability
  - c. Performance/load/stress testing
  - d. Security
  - e. Regression testing
  - f. Portability
  - g. API testing
  - h. Integration testing
  - i. Smoke testing
  - j. Mobile testing
  - k. Others (please enter)
5. Which of the following are your most important priorities when selecting an automation tool? (multiple choice)
- a. Licensing and support costs
  - b. UI/UX
  - c. Functionality/feature-rich
  - d. Level of skills and experience required
  - e. Level of programming skills required
  - f. Support services (troubleshooting, enhancements, feedback, etc.)
  - g. Training, documentation, tutorials, guidelines
  - h. User community
  - i. Good test reports
  - j. Long-term commitments
  - k. Ability to integrate with ALM tools
  - l. CI, DevOps support
  - m. Record/Playback features
  - n. Test execution optimization
  - o. Others (please enter)



## 6. Overall challenges faced in applying test automation in your projects/organizations

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Lack of skilled and experienced resources					
Do not have time for test automation					
Difficulties in preparing test data and environments					
Do not have the right automation tools and frameworks					
Lack of mobile devices ready for testing					
Do not have the right processes and methods for test automation					
Difficult to integrate different automation tools/frameworks together					
Difficult to integrate automation tools to DevOps processes					
Cannot test the interactions between layers of software					
Requirements change too often					
Platforms and testing environments change too often					
Diverse applications and platforms to test					
Do not realize the benefits of test automation					
Lack of support from senior management and/or customers					

## 7. Challenges/problems faced with the existing test automation tools in your projects/ organizations

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Commercial tools are too expensive					
Open-source tools are hard to use					
They (test automation tools) require too much experience and expertise					
They require strong programming skills					
They are time-consuming to learn, difficult to use					
They lack functionality needed					
They are not reliable					
They lack support for mobile testing					
They lack support for API testing					
Difficult to integrate with other ALM tools					
They lack support for testing non-functional requirements (usability, safety, security, etc.)					
Expensive to generate test cases/test scripts					
They require high maintenance costs for test cases, test scripts and test data					
Applications change often, making scripts to break					
Difficult to reuse test scripts and data across stages of testing					
Difficult to organize and manage test artifacts (test cases, scripts, data, reports, etc.)					
They lack analytics capabilities to diagnose test results and make informed decisions					