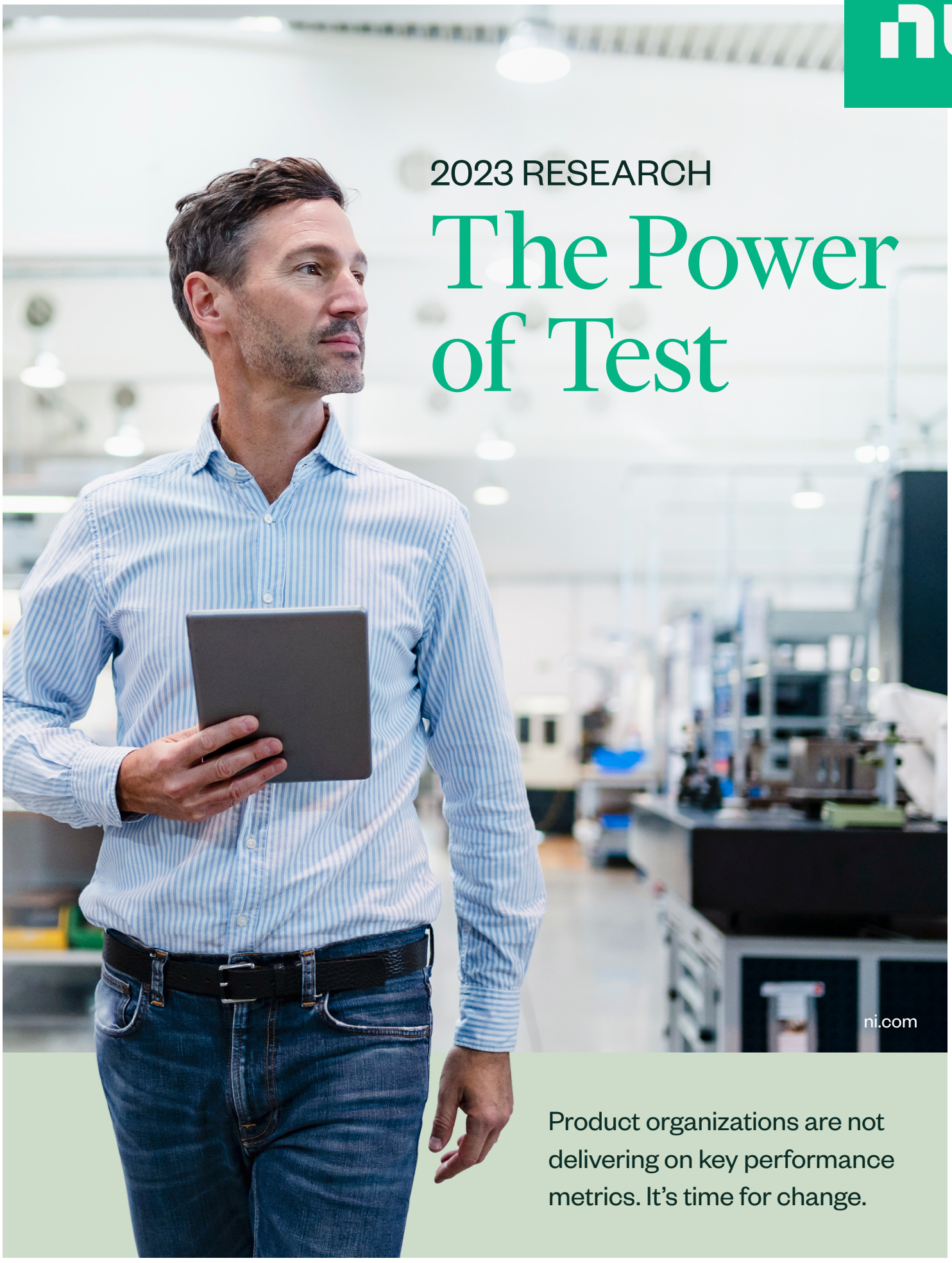

2023 RESEARCH

The Power of Test

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Product organizations are not delivering on key performance metrics. It's time for change.

Executive Summary

The majority of organizations are missing the mark on key metrics, such as product quality and reliability, speed of test, and time to market, according to 200 test leaders from NI's latest research.

The results were striking. For example, while nearly all organizations (83%) prioritize product quality and reliability, only 44% are performing well against this metric.

But why?

The test leaders surveyed cited budget constraints as the biggest barrier preventing their teams from solving the problem. This could be because other functions that can show tangible business outcomes are given precedence. In other words, test is often seen as a cost center, not a key business enabler.

There is, however, a small group of test organizations leading the way. This elite group represents 24% of our survey sample. Their organizations perform above or well above expectations on product quality and reliability, and speed of test.

What makes these leading test organizations different? They:

01 Secure investments in test that match expectations

02 Embrace and understand the value of commercial technologies like advanced automation and model-based test

03 Prioritize AI/ML to meet testing goals

And their investments in technology all require new software-connected approaches to test.

The results are clear—investing in test, even in marginal increments, is necessary to improve product and business outcomes. To get the most out of test, we must take cues from the leading test organizations. In this report, you'll understand how positioning test as a competitive advantage can offer major returns.

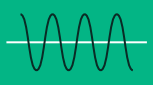
Introduction

An explosion of complexity, connectivity, and functionality is forcing product organizations to rethink their engineering and manufacturing processes.

This means test teams have an opportunity to become business leaders within their organizations through the ability to deliver increasing value from test data. To do this, these teams must recognize the importance of investing in new technologies, especially software for automation, standardization, and digital transformation, to predictably and efficiently deliver test insights that inform product development across the organization. Because, let's face it, delivering quality products to market faster, and at a lower cost, is not the sole responsibility of the test function.

We surveyed 200 test managers, directors, and VPs in the US, China, and Germany. We found that most organizations are struggling on their most important metrics: product quality and reliability, speed of test, and time to market.

Many test teams see new technologies as the key to real ROI but often don't hold the purse strings. That's a problem, because as disruptive technological advances take hold, and product complexity continues to increase, innovating and investing is the only option. And organizations that are investing are seeing results, but only a minority are doing so. What's more, it doesn't take massive investment to move the needle. In fact, 73% of leading test organizations are securing increased investment in test, but a staggering 89% of them are only investing marginal increments to see gains.



Most organizations are failing to exceed expectations on their most important metrics: product quality and reliability, speed of test, and time to market.

In this report, we examine the state of play for test teams and look at how they can learn from the leading organizations in test.

Product Organizations Are Missing the Mark on Key Metrics

Test teams are balancing many competing requirements, but nothing should compromise quality.

Top 3 most important metrics to senior leaders at companies today:

Product quality and reliability	Speed of test/ throughput	Time to market/ project schedules
83%	64%	60%

But product teams are struggling to deliver. Although almost all companies prioritize quality and reliability, only 44% are performing well against this metric.

In fact, less than half of organizations say they're performing well across their most important metrics, with the exception of customer satisfaction.

Ritu Favre, executive vice president and general manager of NI's global business units, cites competing requirements as the root cause of the challenge for test functions.

> "Test teams are constantly caught in the middle of delivering more complex products with higher quality and in less time than before. This demands new test approaches—especially test standardization and data management—to capture new market windows."

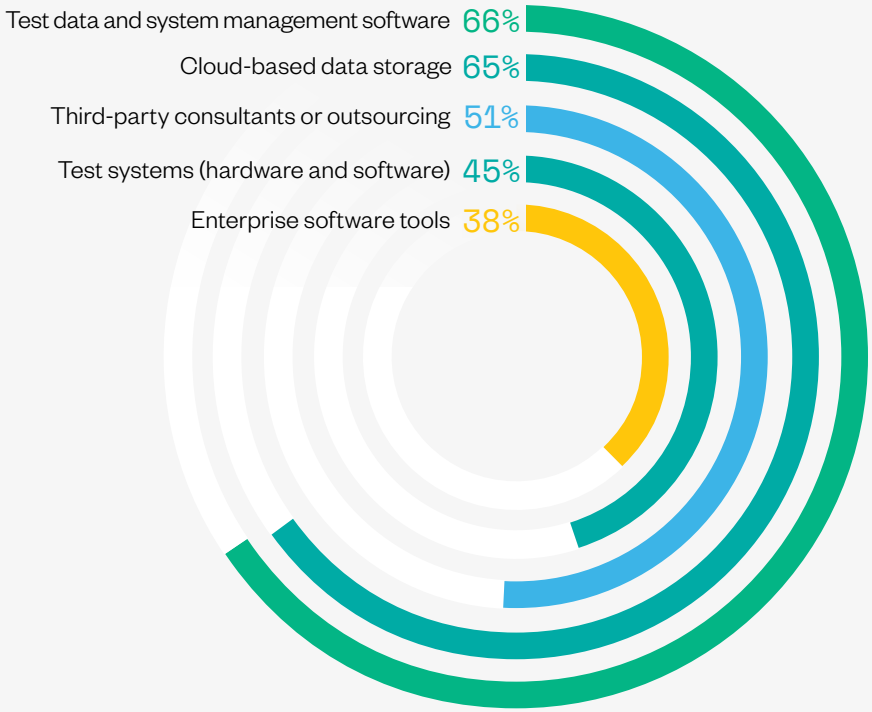
83% of organizations say product quality and reliability is the most important metric to senior leadership, but only 44% say they're managing to perform well against this metric.

It's clear product organizations need to step up. But how can test lead the way?

Improving Outcomes through Key Investments

Test teams know their organizations are underperforming, so they're planning new investments and creating new initiatives to close the gap.

Top 5 investments test teams would like to make to help meet their company's goals:

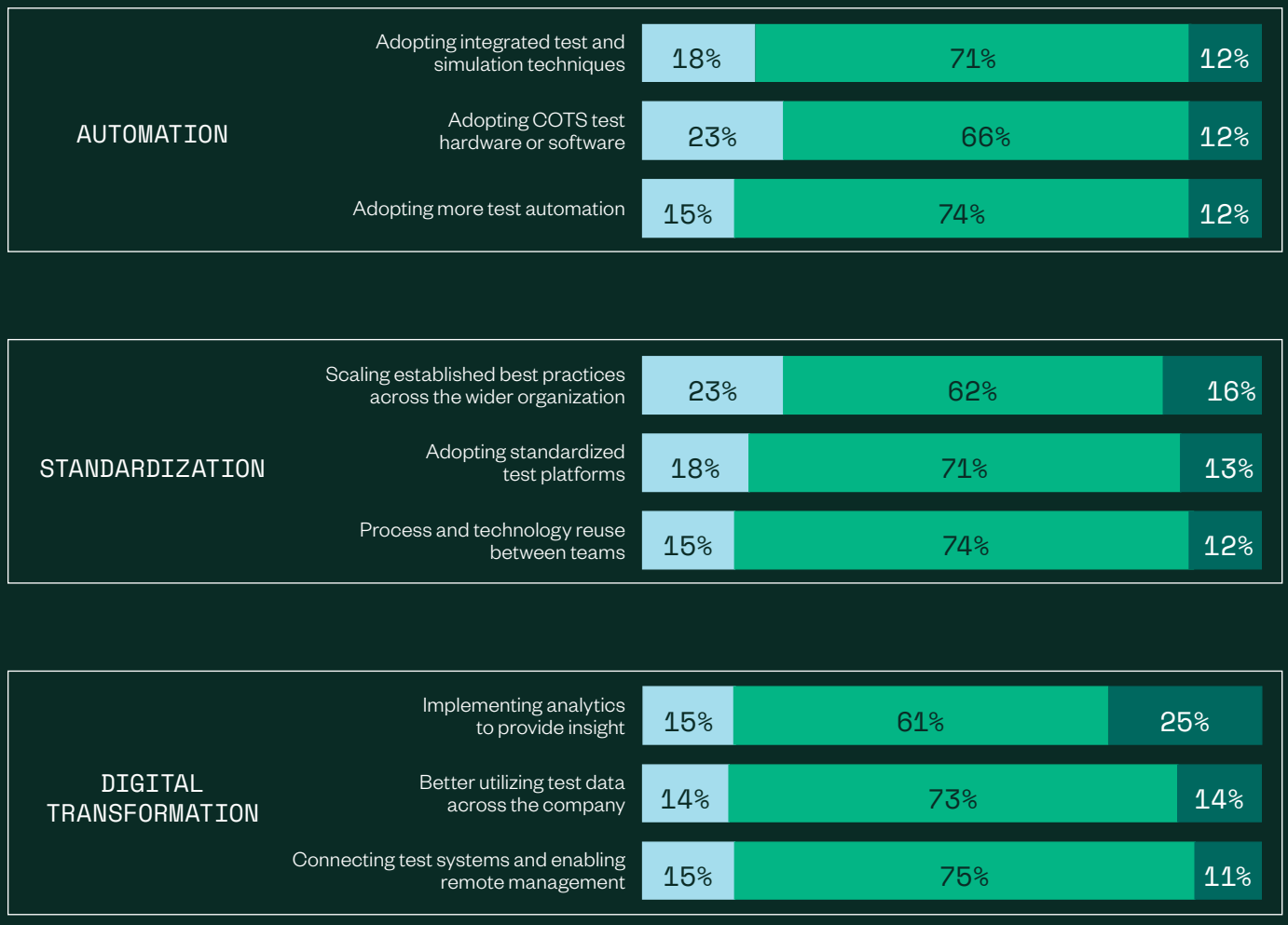


The strong focus on data suggests that test teams recognize the opportunity to use data to improve product development. According to NI's 2022 research, Designed to Perform, 52% of companies with an integrated, company-wide product data strategy experienced faster time to market in the last 12 months, compared to 33% without this advantage. And more than half of the product innovators surveyed say that integrating test data into the product development process will be a key priority over the next 12 months.

Data is the red thread. It's helping companies that are using it today succeed, and it'll ensure future success for those investing in it.

Test organizations are not only focusing on investments to meet their goals though; the number of initiatives is also rising.

Test teams are pressing ahead on important initiatives in the next 12 months



Data may not total 100% due to rounding

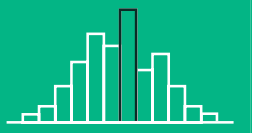
- Not yet planning to implement
- Planning to implement
- Already implementing

Test organizations are considering a range of initiatives in the next 12 months, many of which focus on data and software. There's overwhelming consensus that approaches around automation, standardization, and digital transformation will propel test teams forward to support their companies in meeting their objectives. But, in order to do this effectively, organizations will need to prioritize initiatives as part of an intentional test strategy to deliver the biggest impact to the business.

Budget Battles

While test team leaders are keen to begin these initiatives, they must back them up with investment: 56% of test organizations expect their spending on test hardware, software, and personnel to increase in the next 12 months.

Their instinct to invest in test is proving correct: test teams who increase their budgets are much more likely to perform well on key metrics. But you don't have to spend big to win big—even marginal budget increases can make a big difference.



We found that 54% of organizations that are increasing their test budget perform above expectations on product quality and reliability, compared to just 32% of the rest. It's the same story with speed of test: 44% of those increasing budget perform above expectations, compared to less than a third (31%) of the rest.

In theory, this is great, but limited budget is cited as the biggest issue holding back test teams, partly because other functions that can show more tangible business outcomes are given priority. So, even test teams planning to spend more in the next 12 months may feel they still aren't adequately funded to achieve their goals. That means they have to be really intentional with the funding they do have.

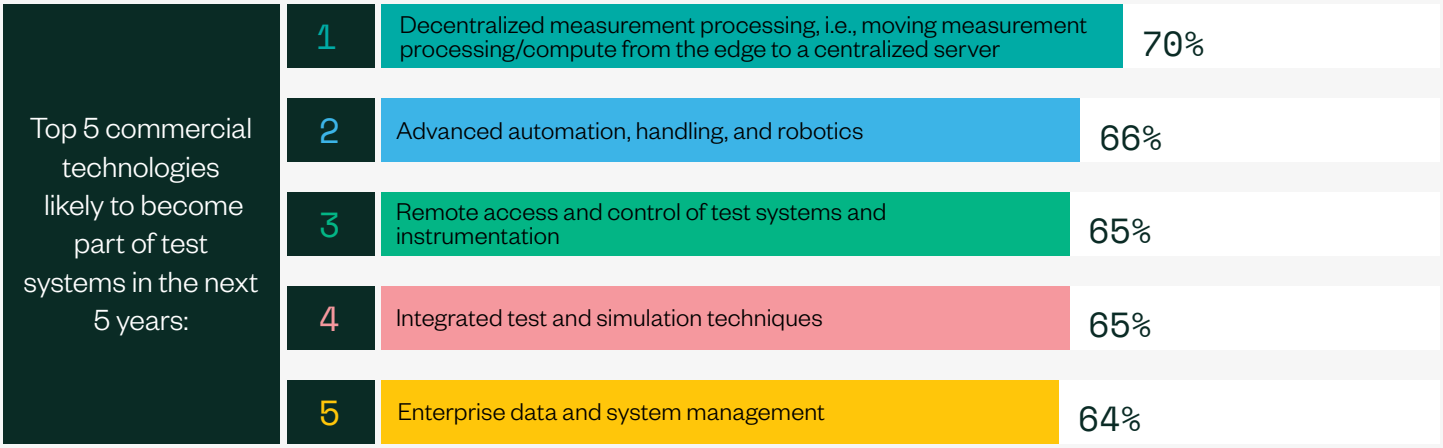
Graham Green, chief solution manager for NI's portfolio business unit, adds that there's a need for a mindset shift.

> "Thinking of test as a value-adding differentiator, rather than a cost center, sets apart the best-in-class companies. Educating leaders around the value of test in terms of quality, time to market, cost savings, returns, and customer satisfaction is important in allowing test to play a wider role. This leads to having a more intentional or proactive strategy, and that will unlock huge value across the organization."

Harnessing the Power of Commercial Technologies

To stay competitive, organizations must find ways to utilize test better throughout the product development lifecycle. By connecting data and test systems, engineering teams can gain insights and make decisions faster to improve products and deliver critical business outcomes.

Luckily, a range of new commercial technologies have the potential to transform test.



Decentralized measurement processing is the top commercial technology driving this change. Respondents believe it shows the most potential for reducing cost and increasing speed of test, throughput, and product quality and reliability—which is why 70% of companies expect it to become part of their test systems in the next five years.

A Note on Measurement Processing

Today, most instruments are PC-based, with an onboard processor responsible for measurement computation. In the future, instruments will likely adopt a more cloud-based model, where users can choose to perform the mathematics, calibration, and signal processing locally (on the edge), on-prem, or in a public cloud. This shift to a cloud-based model will have the benefit of simpler software maintenance and the ability to scale compute and storage up and down based on user need.

Validation vs. Production Test

The test organization is nuanced, and different parts of it are demanding different technologies.

Here's a look at the top commercial technologies expected to become part of different test functions in the next five years.

FOR DESIGN, VALIDATION, AND VERIFICATION

- 72% Decentralized measurement processing
- 72% Advanced automation, handlers, and robotics
- 67% Artificial intelligence/ machine learning

FOR PRODUCTION AND MANUFACTURING

- 69% Remote access and control of test systems and instrumentation
- 65% Microservice-based software architectures for test
- 65% Advanced automation, handlers, and robotics
- 65% Decentralized measurement processing

David Hall, director of NI's global business units, explains that validation test teams are beginning to adopt best practices and technologies from the manufacturing world:

> "We're beginning to see validation teams adopt manufacturing-style approaches to test system and data management in the lab, including the adoption of robotic device handlers to manage testing thousands of product samples.
>
> Increasing levels of lab automation creates the opportunity for engineering teams to produce even more product data—augmenting data sources from simulation and manufacturing test."

Learning from Best-in-Class Test Organizations

The challenges facing the test function are plain to see. Test can be overshadowed by other parts of the business—and often, investment and focus on test don't match management's expectations of test teams. Ultimately, this contributes to the challenge of struggling to meet key business metrics.

However, a small group of companies spread across every industry and country we surveyed are setting the standard. This elite group represents 24% of our survey sample. These leading test organizations perform above or well above expectations on product quality and reliability, and speed of test.

But what are they doing that the rest aren't?

They're securing investment in test, understand the value of embracing commercial technologies, and they're prioritizing AI/ML to meet their testing goals.

Secure Investment in Test

Crucially, leading test organizations are increasing spend to realize their ambitions. Nearly three-quarters (73%) say they are increasing or significantly increasing their spending on test hardware, software, and personnel in the next 12 months, compared to just 51% of the rest. But a little bit can go a long way. The vast majority (89%) do not plan to **significantly** increase their test budget.

Embrace and Understand the Value of Commercial Technologies

Leading test organizations are more likely to be embracing key commercial technologies than the rest; in particular, advanced automation/robotics, AI/ML, integrated test and simulation techniques, and remote access and control of test systems.

Commercial technologies that leading test organizations are likely to embrace in the next five years vs. the rest:

Leading organizations also have far more confidence in the business outcomes of new technologies. For example, 66% expect their AI/ML investments to increase speed of test and throughput, while only 45% of other organizations say the same.

Prioritize AI/ML to Meet Testing Goals

The data in the previous section shows a particular gulf between leading test organizations and the rest when it comes to AI and ML. These two technologies are central to leading organizations' test strategies going forward. They see the potential to revolutionize their workflows with AI/ML as a means to achieving their organization's goals, and they understand the data investments needed to make them operational.

In fact, more than twice as many leading organizations than the rest say advanced analytics (including AI and ML) is the most important data investment they'd like to make in the next two years to meet their testing goals (48% vs. 21%).

This is significant, as it shows the true value leading test organizations see in technologies that will supercharge their ability to deliver on key business metrics.

Conclusion

The increasing pace of innovation is forcing companies to streamline operations to unlock value across the product development lifecycle. Organizations that prioritize and invest in test capabilities, like the leading organizations from our survey, ultimately realize improvements in product quality and development time.

Here's what you can do now:

01

Invest to match expectations

Organizations must invest in test to realize the function's full potential and meet the expectations of leadership. That means test teams are on the hook to educate company leadership on the business value of test.

02

Harness technology

The test function must also expand its impact within the organization by implementing an intentional and software-connected test strategy that includes three technology initiatives:

- **Automation:** Automating measurements with software and instrument control is a required step to modernize a lab or manufacturing facility. Manual approaches to test take far too long and limit the ability to capture test insights and make critical product decisions.
- **Standardization:** Test engineers and teams should standardize or harmonize processes, systems, software, and data across labs and manufacturing sites for faster new product development at lower cost.
- **Digital Transformation:** An often-overused buzzword, many organizations are driving digital transformation initiatives that use test data to improve product development. Doing this effectively not only requires automated and standardized approaches to test; it also requires an intentional approach to data and test system management.

03

Work cross-functionally

Connecting test insights into other engineering functions is critical in unlocking the true power of test. This means test team leaders have an opportunity to become business leaders by driving the use of test data across the organization to improve product and business outcomes.

Follow these steps to ignite progress within your organization. Because utilizing test as a competitive advantage is an opportunity no company can afford to ignore.

Research Methodology

We surveyed 200 leaders who associate with test within design, validation, verification, production, and manufacturing. All are wholly or jointly responsible for purchasing decisions of test equipment or influence those decisions.

COUNTRIES	JOB TITLES	INDUSTRIES	COMPANY REVENUE
USA 50%	VP/SVP/Head of Function 17%	Aerospace/Defense/Government 25%	< $250 million 15%
Germany 25%	Director/Senior Director 24%	Semiconductor 25%	$250 million–$1 billion 25%
China 25%	Senior Manager 32%	Automotive/Transportation 25%	$1 billion–$5 billion 31%
	Manager 28%	Consumer and Industrial Electronics 25%	> $5 billion 29%

Data may not total 100% due to rounding

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