



FORRESTER®

The State Of AI In Engineering

Manufacturers Turn To AI To Improve Product Testing Efficiency And Gain Critical Advantage

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FORRESTER OPPORTUNITY SNAPSHOT: A CUSTOM STUDY COMMISSIONED BY MONOLITH | MAY 2023

Manufacturers Require Meaningful Insights To Improve Product Testing Efficiency

In an increasingly challenging economic climate and competitive market, manufacturers must launch new, innovative products faster to survive.¹ The requirements to build and test physical models are onerous in industries with complex, interconnected systems resistant to modeling — and they can jeopardize the ability to respond competitively. Artificial intelligence (AI) can help engineering leaders reduce the number of simulation and test cycles and glean more insights from data.

In February 2023, Monolith commissioned Forrester Consulting to conduct a study of 163 engineering leaders to understand their organizations' challenges and priorities during the validation and verification stage of the engineering workflow and how AI can empower their efforts.

Key Findings



Engineering leaders lack meaningful insights into their testing and validation processes, struggle to improve time to market for new complex products, and face immense financial risks from delays.



Existing validation methods fall short, and most engineering leaders don't have the right technology to efficiently analyze test data. Talent scarcity and skills-related challenges further stifle progress.



The majority of engineering leaders will significantly increase the implementation of AI in their engineering workflows to accelerate product testing and gain competitive advantage.

Inefficient Testing Exposes Manufacturers To Immense Financial Risks

Inefficient testing and the resulting product delays pose a huge financial risk to manufacturers. A one-month product launch delay could cost an organization millions or even billions of dollars, according to 82% of surveyed engineering leaders. Nearly half (48%) are expecting millions or billions in cost each time they create an accurate, data-driven model late in the process (after testing a prototype) or if they have to recall a product due to quality issues. To remain sensitive to budgets in today's climate, it is of paramount importance that engineering leaders spend less time running expensive tests and more time learning from their engineering data to predict performance more accurately and exact tests to run.

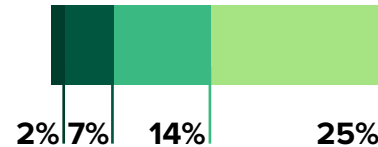
“What is the cost of each of the following in a typical product development cycle (in USD) at your organization?”



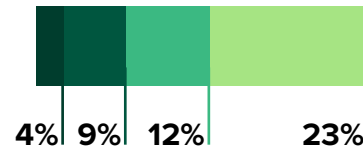
Product launch delayed by one month



Creation of an accurate data-driven model after testing a prototype



Recalls due to product quality issues



Engineering Leaders Risk Losing Market Share Without Advanced AI Solutions

Engineering leaders need to find ways to speed up their organizations' innovation processes to stay competitive (71%). Reducing the number of modeling iterations by extracting the most from test data can help them achieve this. However, traditional tools are inadequate at analyzing large amounts of data. Fifty-five percent of respondents report that existing virtual validation tools are not reliable enough to guarantee that designs pass validations.²

AI offers a more effective route to reliable insights than traditional methods. Adopting AI is an imperative tool for securing market share: 67% of engineering leaders feel pressure to implement AI in their engineering workflows to avoid losing competitive advantage.

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“How much do you agree with the following statements when it comes to the development of new, hard-to-model products involving complex, nonlinear physics?”

(Showing “Strongly agree” and “Agree” responses combined)

We need to find ways to speed up the ideation and launch of new, complex products and systems to stay competitive.

71%

We need to find ways to reduce the cost of design iterations.

69%

We feel pressure to adopt artificial intelligence (AI) in our engineering workflows to avoid losing competitive advantage.

67%

We risk delaying product launch schedules because of too many iterations between designing and testing.

64%

Supplier and component shortages are putting pressure on our engineering teams to validate our products quickly for alternative components.

61%

We need to find ways to reduce the number of design iterations.

61%

Existing virtual validation tools, such as physical simulation, are not reliable enough to guarantee that designs pass validations.

55%

The current recessionary economy is putting pressure on engineering teams to work more efficiently.

47%

Base: 163 decision-makers responsible for product testing and validation at companies in the automotive, aerospace, or industrial/manufacturing industries in the US and Europe
Source: A commissioned study conducted by Forrester Consulting on behalf of Monolith, February 2023

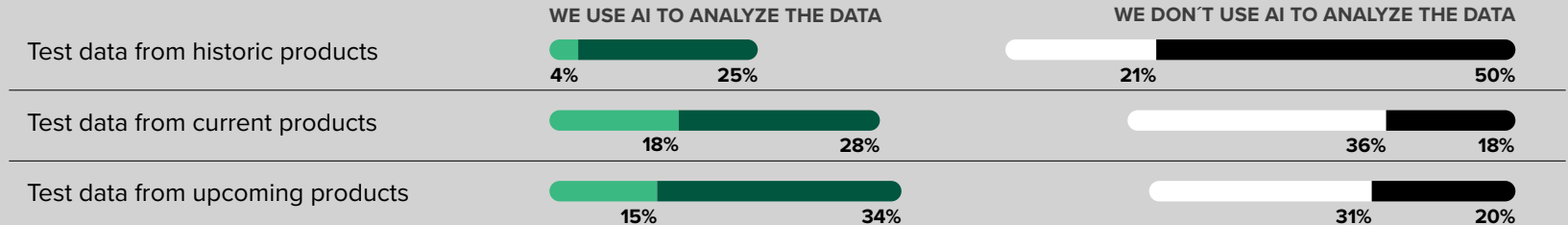
Engineering Leaders Don't Unlock The Full Value Of Their Data Inventory

Only a few companies make the most of their engineering data potential, despite already having spent the money to gather it. On average, only 50% of surveyed engineering leaders use AI to analyze test data from current or upcoming products, and only 29% use it to analyze test data from historic products. Half of all respondents don't analyze historic data at all.

Engineering leaders are especially missing out when it comes to unsupervised learning algorithms — less than 19% use this advanced method to analyze their test data. However, unsupervised learning algorithms are particularly crucial when testing products that are hard to model and involve complex, nonlinear physics. They enable instant analysis of vast amounts of data and help engineers discover unexpected risks and find patterns without defined hypotheses.

“How does your organization currently store and use engineering test data to support the validation and verification of new, hard-to-model products and systems involving complex, nonlinear physics?”

- We use unsupervised learning algorithms (i.e., machine learning) to perform root cause analysis with this data.
- We use supervised learning algorithms (i.e., machine learning) to perform root cause analysis with this data.
- We use advanced analytics to analyze it but do not employ machine learning or artificial intelligence.
- We don't utilize or analyze the data.



A Lack Of Qualitative Insights Impacts Time To Market Of New Products

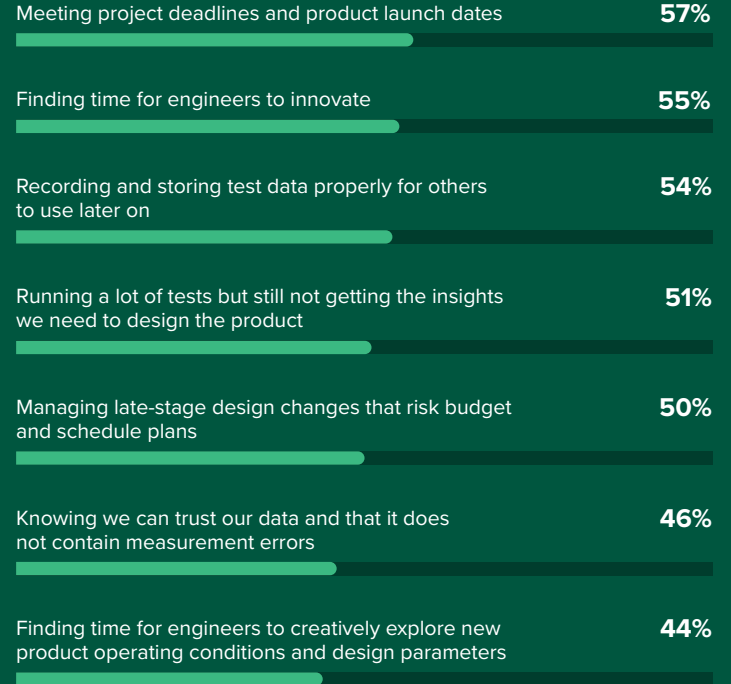
The process of testing and validating new, complex products that are hard to model in a timely manner is arduous: Meeting project deadlines and product launch dates is the number one challenge for interviewed engineering leaders (55%). It is not surprising that they are not getting the insights they need to design the right product in spite of running a lot of tests, (51%). More effective insights mean fewer test model cycles.

Additionally, engineering leaders struggle to empower their teams to be more efficient — no time for innovation (55%) and creativity (44%) and a lack of trustworthy data (46%) that is properly recorded and stored (54%) prevents leaders from finding those complex but critical patterns and insights. Late-stage design changes that risk budget and schedules are often the result (50%), putting a manufacturer’s ability to respond competitively and in a timely manner in jeopardy.

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“How challenging are the following for your organization when it comes to the validation and verification of new, hard-to-model products and systems involving complex, nonlinear physics?”

(Showing “Strongly agree” and “Agree” responses combined)



Base: 163 decision-makers responsible for product testing and validation at companies in the automotive, aerospace, or industrial/manufacturing industries in the US and Europe. Note: Showing top seven responses. Source: A commissioned study conducted by Forrester Consulting on behalf of Monolith, February 2023

Technology And Workforce Issues Hinder Product Testing And Validation

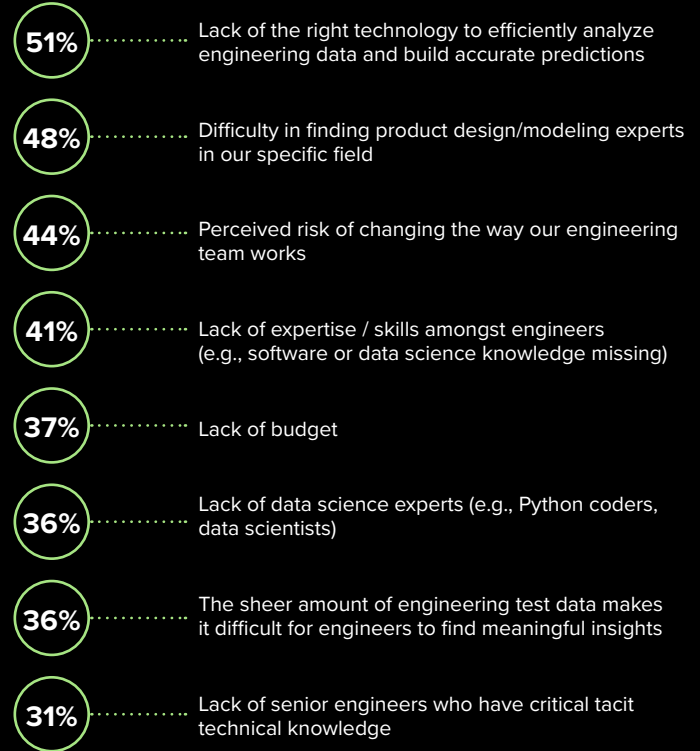
Engineering leaders face hurdles in trying to overcome their testing and validation challenges. They center around:

TECHNOLOGY. Despite the significant pressure to adopt AI, few engineering leaders are using it to its full potential. The majority don't believe they have the right technology to efficiently analyze engineering data and build accurate predictions (51%).

TALENT SCARCITY. Engineering leaders struggle to find experts for product design (48%) and data science (36%). This makes it difficult to bridge the gap in their existing resources that lack software and data science skills (41%) and critical tacit technical knowledge (31%).

FEAR OF CHANGE. More than two in five engineering leaders stifle progress due to a perceived risk in changing the way their team works (44%).

“What are the biggest barriers to overcoming the challenges with the validation and verification of new, hard-to-model products and systems involving complex, nonlinear physics?”



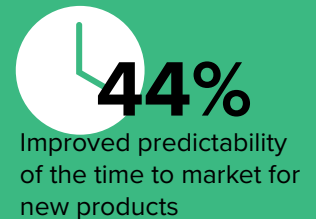
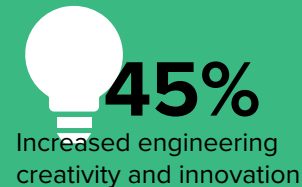
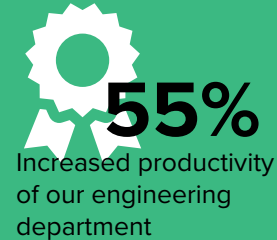
Engineering Leaders Expect A Wide Range Of Benefits From Implementing AI

All surveyed engineering leaders see benefits of implementing AI to support product testing and validation, and some of the benefits go beyond that work group. Forty-seven percent report that their company experiences higher revenue, profitability, and competitiveness as a result of implementing AI. Leaders say that engineers armed with AI tools are more productive (55%) and creative (45%). Having better product and testing insights (52%) enables them to avoid wasted design efforts and accurately predict the time to market for new products (44%).

AI solutions help engineering leaders bridge the gap in the talent pool: More effective use of design and test resources (45%) and increased retainment and transfer of knowledge and expertise (35%) can help overcome this barrier that hinders the efficacy of testing and validation. This is particularly important in recessionary times when teams become leaner.

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Expected Benefits From AI Implementation In Engineering Workflows



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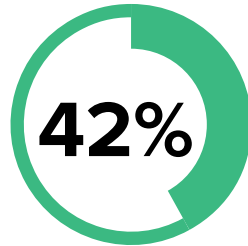
Note: Showing top six responses

Source: A commissioned study conducted by Forrester Consulting on behalf of Monolith, February 2023

Engineering leaders' organizations that implemented AI in their engineering workflows perform better: they are **43% more likely to see an increase in revenue, profitability, and competitiveness.**

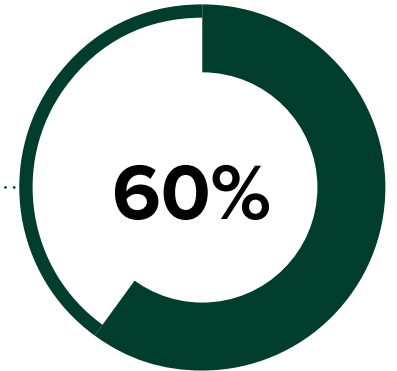
“What benefits do you experience/expect to experience as a result of implementing AI in engineering workflows to analyze test data?”

INCREASED REVENUE, PROFITABILITY, AND COMPETITIVENESS



Respondents whose company has not yet implemented AI (N=113)

Respondents whose company has implemented AI (N=50)



Engineering Leaders Will Significantly Increase The Implementation Of AI In Their Workflows

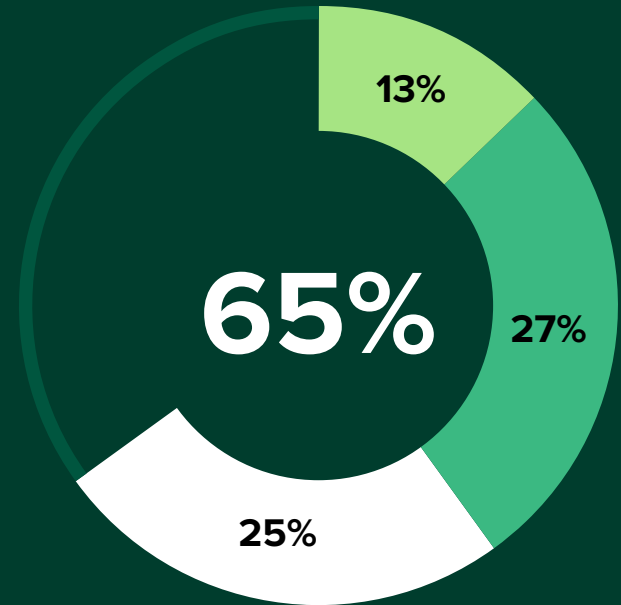
Given the immense financial risks from delayed product launches, ever-rising market expectations, and the benefits to be gained from using AI, it is no surprise that engineering leaders show high interest in AI solutions that can help them increase testing efficiency.

The demand is surging rapidly: 52% of engineering leaders told us they are interested in implementing AI in their engineering workflows and have already embarked on the journey towards implementation by defining business cases or exploring vendors. Additionally, 13% of surveyed engineering leaders who have fully implemented AI in their engineering workflows plan to expand or upgrade their current implementation.

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65% of surveyed engineering leaders are currently expanding their AI implementation, exploring AI vendors, or defining their AI business case

- Implemented AI and currently expanding
- Interested and currently exploring vendors
- Interested and currently defining the business case



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Source: A commissioned study conducted by Forrester Consulting on behalf of Monolith, February 2023

High-Performance, Easy-To-Integrate AI Solutions Bolster Engineering Workflows

When looking for the ideal AI solution for engineering workflows, engineering leaders value a range of attributes that aid their efforts with product testing and validation.

The ideal tool should leverage high performance computation (54%). Since companies' own servers often cannot handle big data, allowing engineers to work faster with it is critical to avoid bottlenecks. In addition, engineering leaders favor tools that support end-to-end integration with existing data science solutions (40%). No one wants another silo in complex processes — when something integrates easily, it unlocks greater insights and faster deployment. Another key attribute engineering leaders are looking for is domain-specific competence, offered through experts (48%) and templates (34%) to help them combat talent- and skills-related difficulties.

54%

It leverages high performance computation.

48%

It is supported by domain experts.

40%

It allows us to integrate existing data science solutions easily.

37%

It is trustworthy in production.

34%

It offers domain specific use case templates.

31%

It has been adopted by other respected engineering teams.

28%

It does not require knowledge of Python.

27%

It is geared towards engineering applications.

“Thinking of the ideal AI solution for engineering workflows, what attributes are your organization looking for?”

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Conclusion

Engineering leaders understand the importance of AI for their organizations' product testing and validation, and they feel pressure to adopt a solution to stay competitive. Few have realized this yet, but their worlds are changing fast, and for good reasons: Those who implemented AI in their engineering workflows are 43% more likely to perform better - and are more likely to meet product launch dates, gather the critical insights they need from their tests, and have more creative and innovative engineering teams.

With an influx of AI solutions everywhere, engineering leaders must choose well. The right AI tool must be geared specifically towards engineers and support them with domain and data expertise to unlock their creativity and potential to test less, learn more, and build high-quality products in a fraction of the time.

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Methodology

This Opportunity Snapshot was commissioned by Monolith. To create this profile, Forrester Consulting supplemented this research with custom survey questions asked of engineering decision-makers responsible for product testing and validation at companies in the automotive, aerospace, and industrial/manufacturing industries in the US and Europe. The custom survey began in February 2023 and was completed in March 2023.

ENDNOTES

¹ Source: "The Future Of Manufacturing," Forrester Research, Inc., September 9, 2022.

² Existing virtual validation depends on the approximations of disciplines such as fluid mechanics which, in practice, are insufficiently reliable to guarantee first-pass validation success for complex designs with nonlinear interdependencies.

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Demographics

COUNTRY	
United States	49%
United Kingdom	17%
Germany	17%
France	17%

REVENUE (USD)	
More than \$2B	74%
\$1B to \$2B	15%
\$500M to \$999M	10%
\$400M to \$499M	1%

INDUSTRY	
Automotive	36%
Industrial/ manufacturing	33%
Aerospace	31%

POSITION	
C-level executive	25%
Vice president	35%
Director	40%



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