

Modeling and Simulation Technologies are Accelerating Digital Transformation

How the industrial machinery industry is embracing modeling and simulation to create better processes and products, all while lowering costs and time to market.

State of the Market Report

Modeling and Simulation Technologies are Accelerating Digital Transformation

TABLE OF CONTENTS

- Executive Summary.....3
- Why This Research was Conducted3
- About the Survey Respondents and Their Organizations.....4
- The Digitally Enabled Path to the Future8
- The Business Case for Modeling and Simulation Technologies.....10
- Types of Modeling and Simulation Technologies.....13
- The Journey is Well Worth It16
- Conclusion.....18



Executive Summary

For manufacturers, the pace of change—and the depth of change—has certainly expanded in recent years. In responding to this ever-evolving climate, manufacturers have accelerated digital transformation in many of its forms. This report focuses on one example of that digital transformation: How the industrial machinery industry, which manufactures equipment used to make other machines, is leveraging modeling and simulation technologies for assessing performance engineering.

What this report illustrates is that digital transformation is amongst the most important activities and largest investments being made by the industrial manufacturing industry. It also demonstrates that modeling and simulation technologies are not only being heavily utilized now but also heavily invested in for the future. The business case for—and advancement in—these technologies shows that the current use case is not only proven at the bottom line, but the potential of these technologies is yet to be fully realized and explored.

65% of respondents see the use of, and continued investment in, modeling and simulation technologies as important or mission-critical.

Why this research was conducted

The intention of this report is to provide a current glimpse of how industrial manufacturers are using modeling and simulation technologies and:

- How they are investing in the future of them;
- Where they are seeing the most value and benefit;
- Identifying specific use cases; and
- What they look for in a partner to help them get the most out of these technologies.

Key Findings

Digital Transformation = Higher Performance:

The better performing companies are also ahead of their peers on their digital transformation journey

Companies are using modeling and simulation technologies for:

- Increasing product quality
- Improving manufacturing
- Reducing time to market

Top simulation technologies include:

- Design for reliability (DFR)
- Material modeling
- System simulation

For you, the reader, we hope that because of this report you feel more informed about the value of these technologies, and energized to get the most out of them in your organization.

About the survey respondents and their organizations

Modeling and simulation technologies help manufacturers design, verify, and validate the intended function of a product or process under development with a virtual, non-physical model. Through these technologies, companies can reduce costs, experiment with and test innovations in a low risk/cost environment, increase the quality and lifespan of products and systems, accelerate time to market, and document and archive lessons learned.

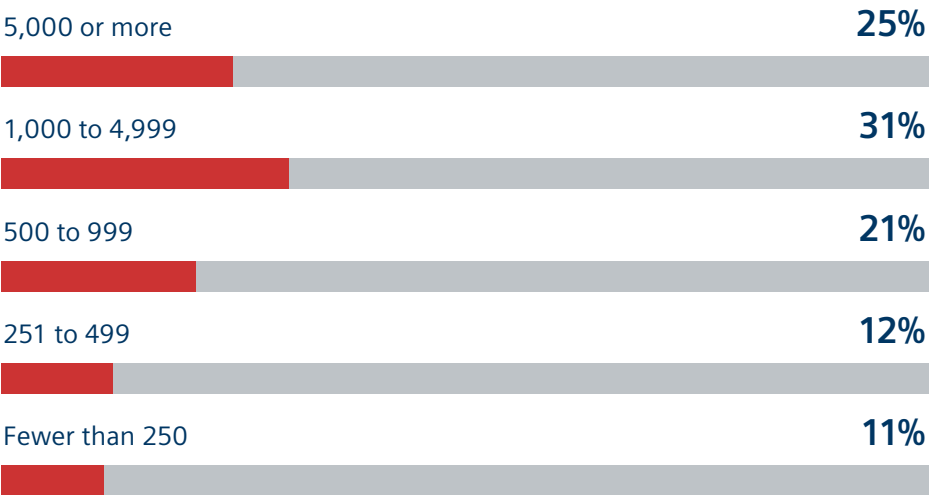
To understand how these technologies are being used in the industrial machinery industry, a survey was conducted in June of 2022 in which 149 people responded. Equipment, machinery, automation, motion and robotics ranked as the top products produced. However, those who manufacture a broad range of products—including pumps and compressors, HVAC, power transmission, tools, materials handling, fluid power systems, and other products—also responded.



Company Profile

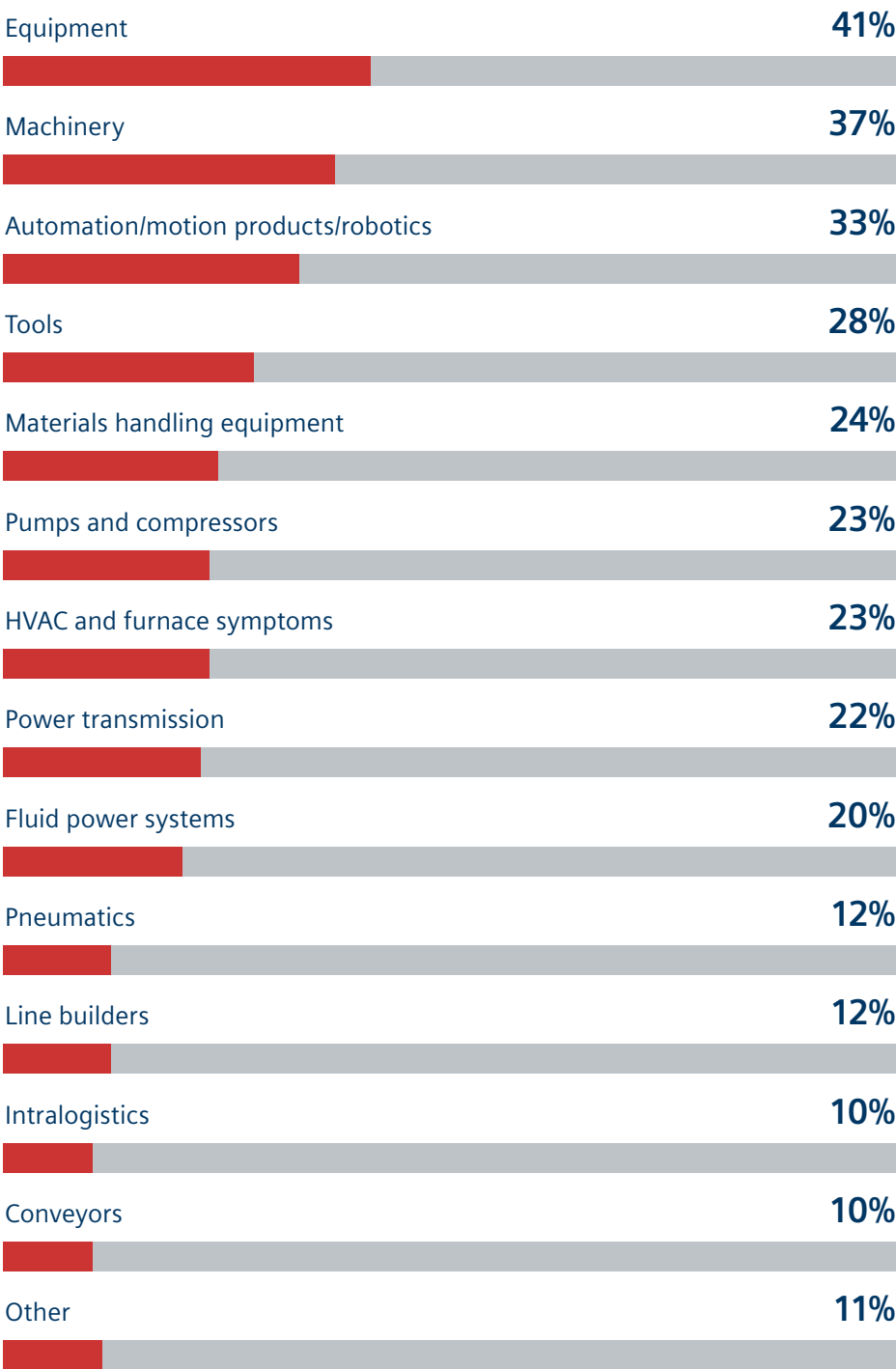
Respondents are likely to manufacture **equipment** (41%), **machinery** (37%), and/or **automation/motion products/robotics** (33%). The majority of respondents (56%) work for companies with **1,000 or more employees**.

What is the number of employees in your company across all locations?



Base: All respondents (n=147).

What are your company's primary products?



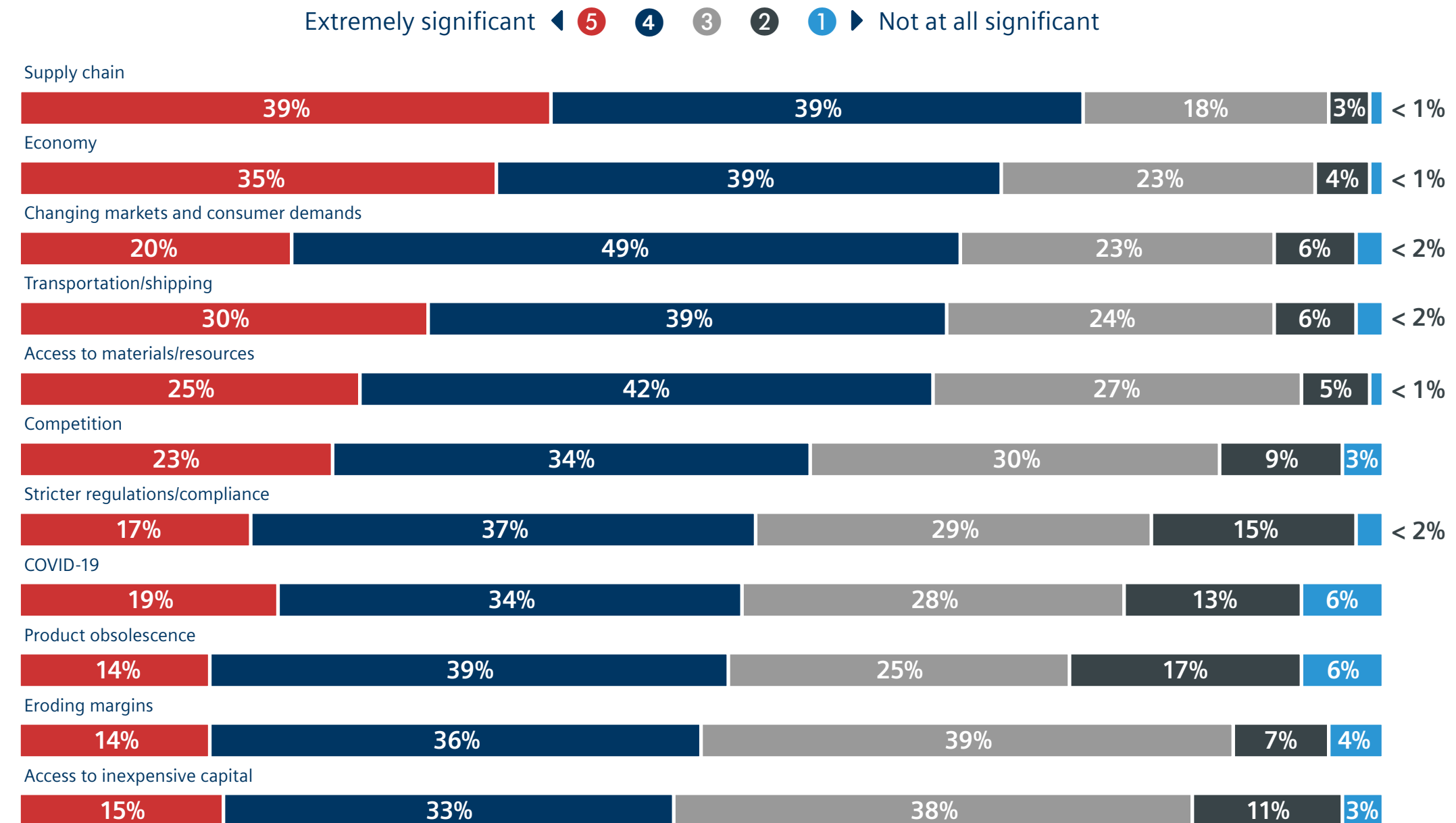
Base: All respondents (n=147); multiple answers allowed.

External Challenges

Organizations expect **supply chain challenges** and **economy challenges** to have the most significant impact on the growth of their organization over the next three years.

Fifty-six percent of the companies surveyed have 1,000 or more employees, 91% of the respondents are currently in a management or higher position within the company, and the vast majority work in information technology, operations/logistics/production, or product design and engineering. The survey respondents represent a relevant audience whose insights about their companies, and their use of modeling and simulation technologies, are quite revealing. The top three external challenges to growth respondents will face over the next three years are 1) supply chain, 2) economy, and 3) changing markets and consumer demands.

Please rate the following external challenges to the growth of your organization over the next three.



Base: All respondents (n varies from 140 to 143)

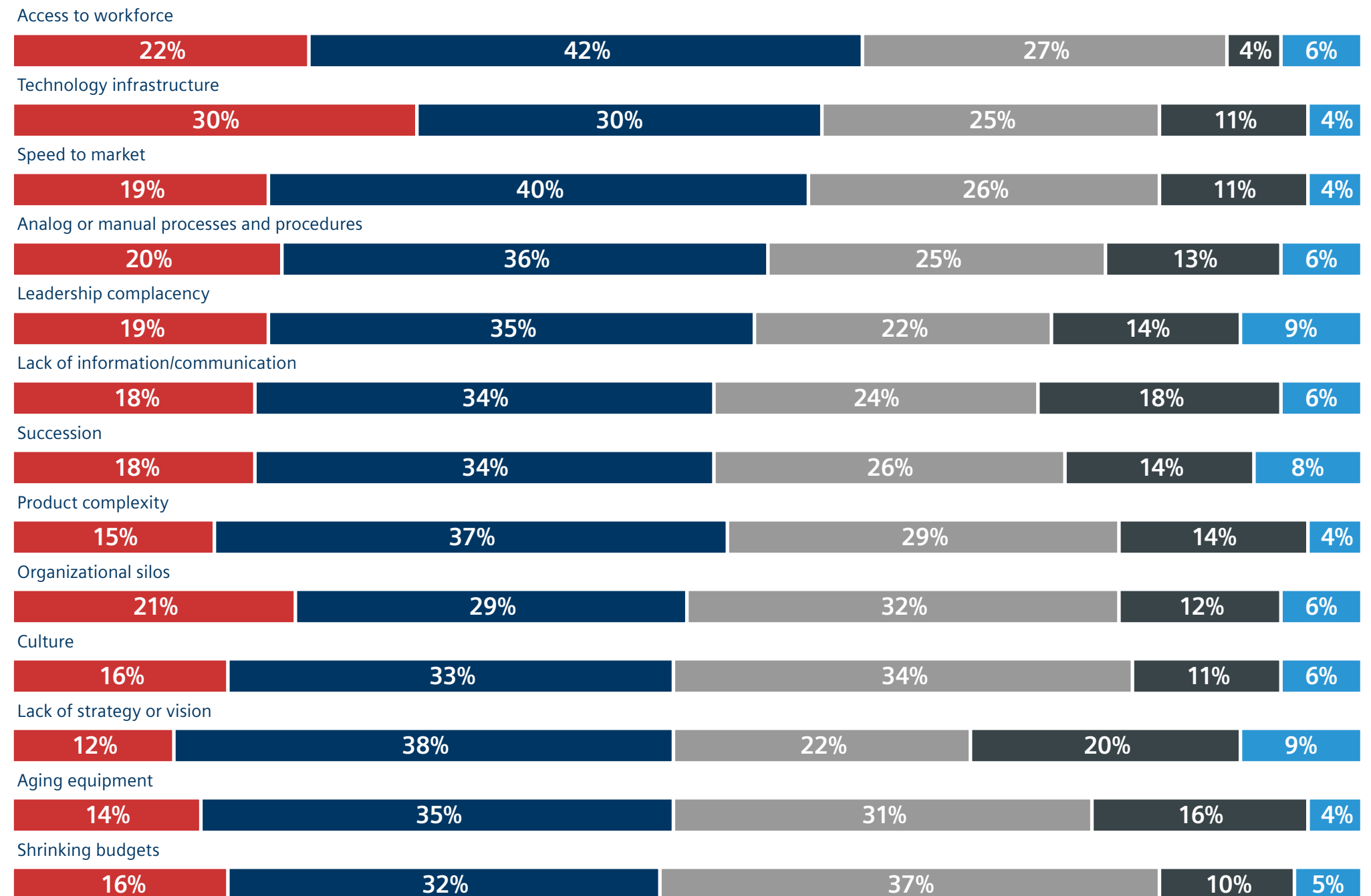
Internal Challenges

Internal challenges that respondents expect to impact the growth of their organization over the next three years include **access to workforce**, **technology infrastructure**, and **speed to market**.

Of those surveyed, 90% say their company is performing in line or beyond projections (29% are performing beyond, 61% performing in line with, and 10% are performing below projections). This is certainly evidence that demand for industrial products is strong, at least for now. As for internal challenges, respondents state that: 1) access to workforce, 2) technology infrastructure, and 3) speed to market are the most significant. Much more about the significance this has to the topic at hand lies ahead in this report.

Please rate the following internal challenges to the growth of your organization over the next three years.

Extremely significant ◀ 5 4 3 2 1 ▶ Not at all significant



Base: All respondents (n varies from 140 to 143)

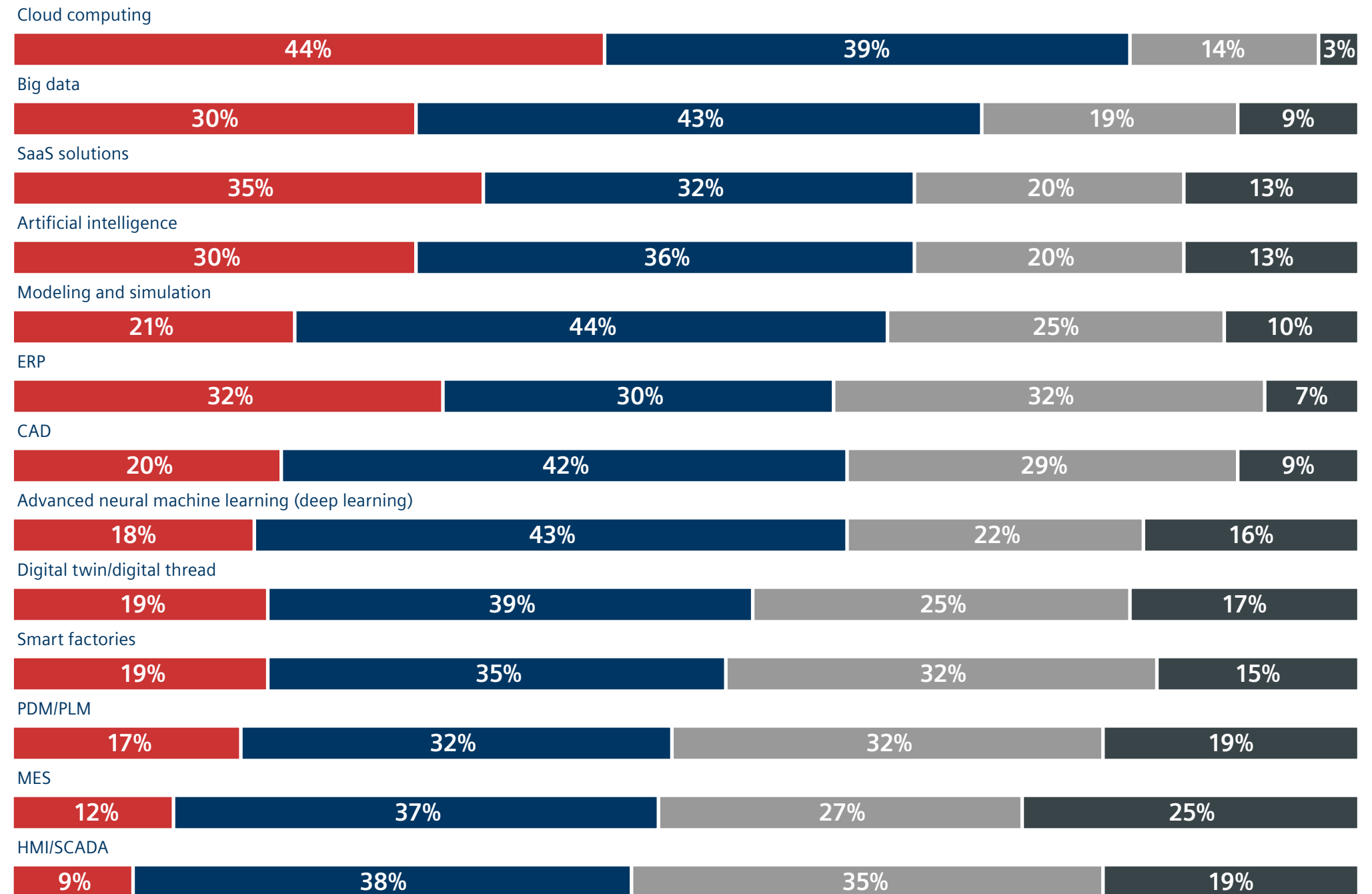
Levels of Recent Technology Investments

Respondents indicate their company has invested most heavily in **cloud computing** in the last two years. **Big data, SaaS solutions, AI, and modeling and simulation** have also been the focus of extensive or medium investment.



How would you rate the level of your company's technology investment in each of the following areas in the last two years?

● Extensive investment ● Medium investment ● Minor investment ● No investment at all



Base: All respondents (n varies from 133 to 136).

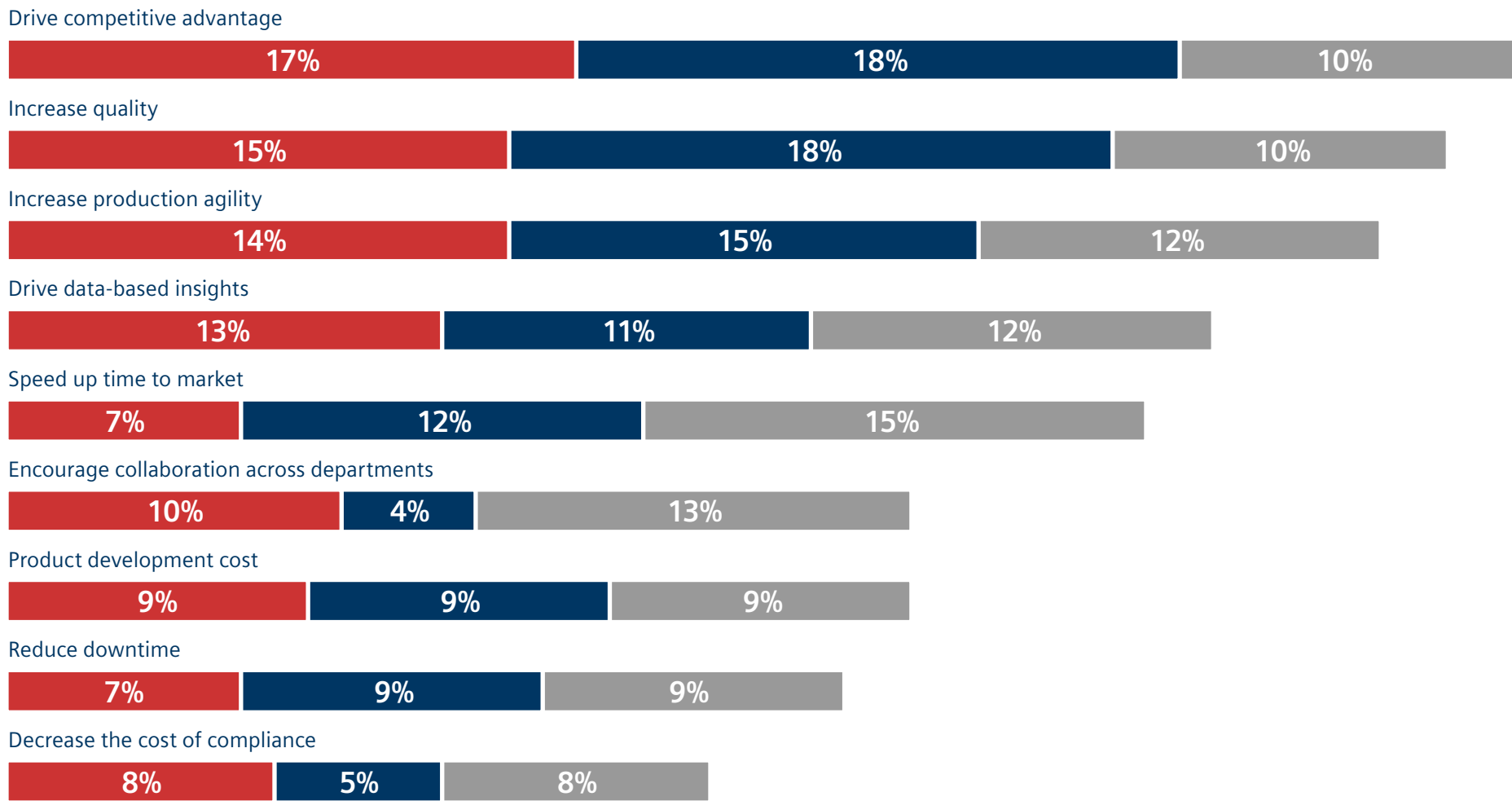
The digitally enabled path to the future

This and other studies suggest that the disruptive attributes of COVID-19 have accelerated digital transformation and the march toward Industry 4.0. IT security, organizational intelligence (IoT), and product life cycle/product data management rank among the top strategic investments being made. In addition, 80% of respondents rate digital transformation four or five on a five-point scale. The benefits companies seek most from digital transformation include 1) driving competitive advantage, 2) increasing quality, and 3) increasing production agility.



What are your goals for digital transformation?

● First choice ● Second choice ● Third choice



Base: All respondents (n=137).

With employee training and education ranked second as a key strategic investment, there will be increased demand for hiring and training the workforce needed to harness the benefits of digital transformation. It’s also worth noting that those reporting performance beyond projections indicate they are ahead of their industry peers on their digital transformation journey. With these results, the connection between higher performance and key technology investments is strong and only gets stronger as it relates to modeling and simulation technologies.

Sixty-five percent of respondents see the use of—and continued investment in—modeling and simulation technologies as important or mission-critical. Companies are using modeling and simulation technologies for increasing product quality, improving manufacturing and reducing time to market. Respondents reported that top simulation technologies include design for reliability (DFR), material modeling and system simulation.

How would you rate the state of your digital transformation journey?

	Number of employees				Organizational Performance		State of Digital Transformation	
	All respondents	Less than 1,000	1,000 to 4,999	5,000 or more	Beyond projections	At or below projections	Ahead of Peers, Industry, or All Industries	Inline with or behind Peers or Industry
Ahead of any industry	9%	10%	7%	8%	17%	4%	21%	-
Ahead of your industry/peers	33%	22%	55%	28%	57%	23%	79%	-
In line with your industry/peers	46%	50%	29%	58%	19%	58%	-	79%
Just getting started	9%	13%	7%	6%	7%	11%	-	16%

Future Technology Investment Plans

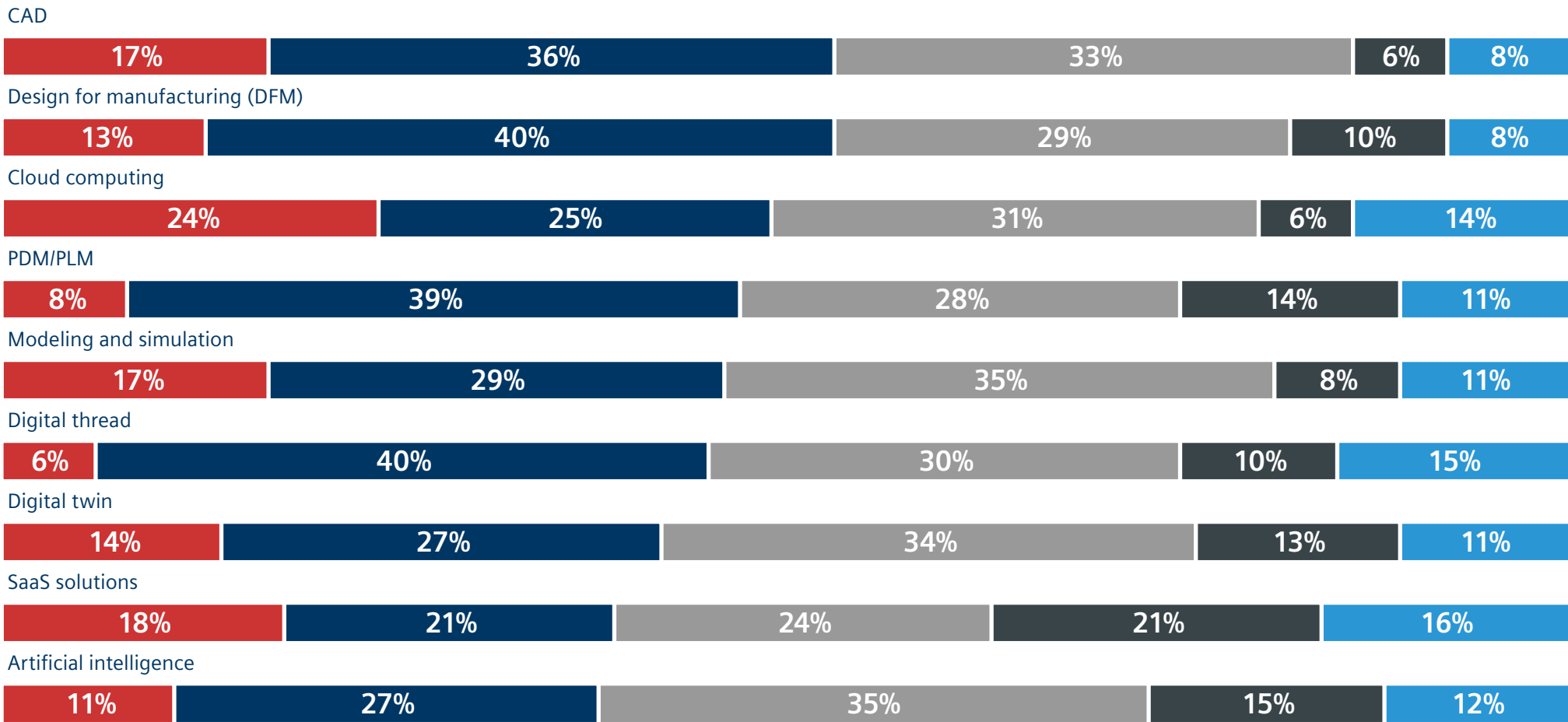
Companies are most likely to add CAD, DFM, and cloud computing over the next two years if they are not currently investing in these technologies.

The business case for modeling and simulation technologies

When asked what solutions or processes companies are using now for product and process design, cloud computing, SaaS solutions (both enabling technologies) and modeling and simulation ranked the top three. When asked about current investments, 90% indicated they are currently investing in modeling and simulation technology, with 21% extensively investing. But the potential is far from realized as indicated by the fact that 64% of respondents are planning to continue to invest in modeling and simulation technologies over the next three to five years.

Which of the following solutions or processes does your agency/organization plan to invest in or implement over the following timeframes?

● Short-term (0-12 months) ● Medium-term (1-2 years) ● Long-term (3-5 years) ● No plans to invest ● Don't know



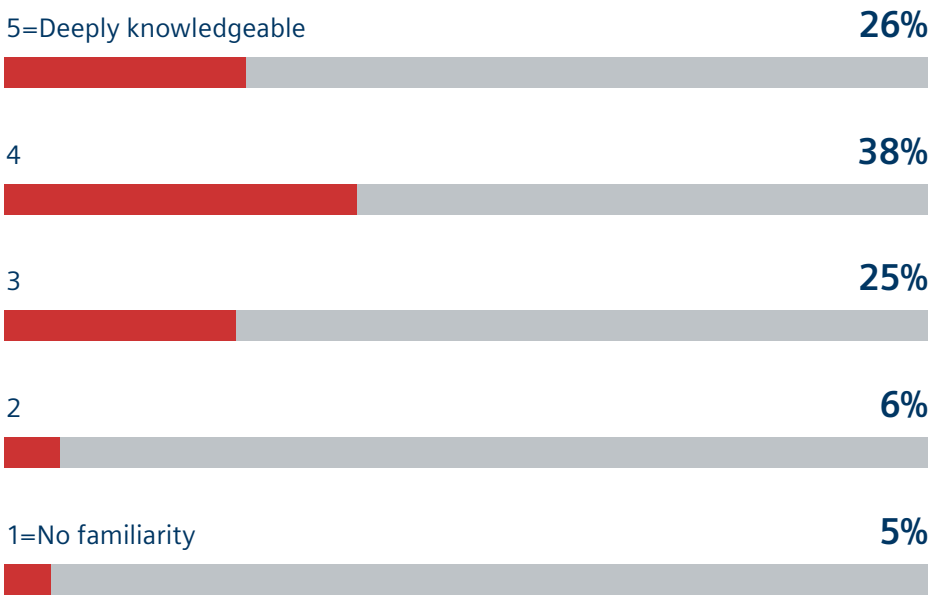
Base: Respondents who do not currently use each technology (n varies from 51 to 113).

Modeling and Simulation Knowledge and Importance

The majority of respondents (64%) are familiar with modeling and simulation technologies, with 65% reporting that these technologies are mission critical now and in the future.

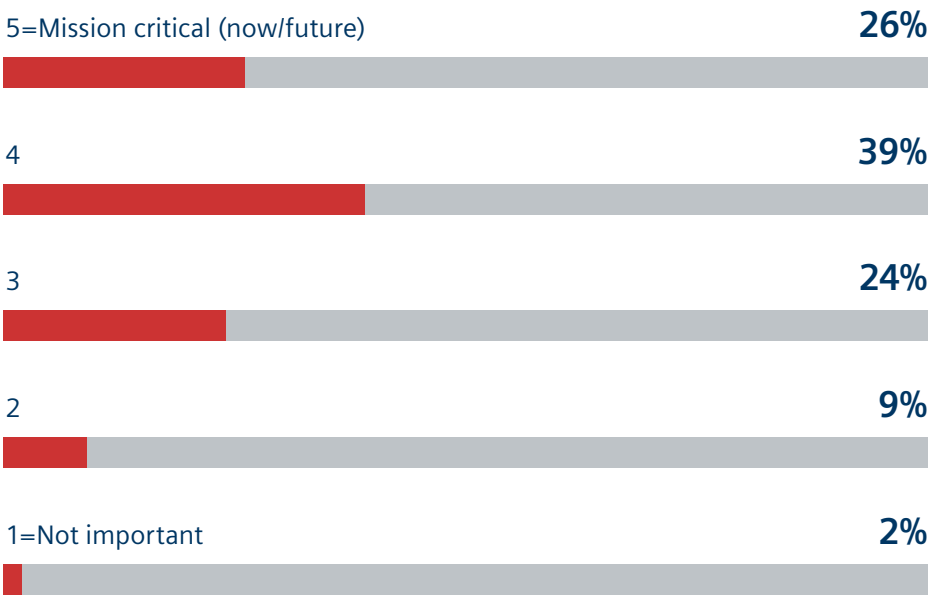
Respondents are very familiar with modeling and simulation technologies, with 64% stating they consider themselves knowledgeable, or deeply knowledgeable. Similarly, 65% see these technologies as important or mission critical. In addition, those who described their company performance as beyond projections are also the ones who are more familiar with—and see more value in—modeling and simulation technologies. This again supports the fact that these technologies are good for the bottom line. Not surprisingly, these same respondents identified as ahead of their peers on digital transformation.

To what degree are you familiar with modeling and simulation technologies?



Base: All respondents (n=137)

To what degree are modeling and simulation technologies important to your company now and in the future?



Base: All respondents (n=135)



To what degree are you familiar with modeling and simulation technologies?

	All respondents	Number of employees			Organizational Performance		State of Digital Transformation	
		Less than 1,000	1,000 to 4,999	5,000 or more	Beyond projections	At or below projections	Ahead of Peers, Industry, or All Industries	Inline with or behind Peers or Industry
1=No familiarity	5%	5%	5%	6%	-	7%	-	9%
2	6%	10%	2%	3%	-	9%	2%	9%
3	25%	27%	17%	31%	14%	30%	12%	34%
4	38%	28%	43%	49%	43%	35%	48%	30%
5=Deeply Knowledgeable	26%	30%	33%	11%	43%	19%	38%	18%
Base	137	60	42	35	42	94	58	79

Base=All respondents

To what degree are modeling and simulation technologies important to your company now and in the future?

	All respondents	Number of employees			Organizational Performance		State of Digital Transformation	
		Less than 1,000	1,000 to 4,999	5,000 or more	Beyond projections	At or below projections	Ahead of Peers, Industry, or All Industries	Inline with or behind Peers or Industry
1=Not important	2%	3%	-	3%	-	3%	2%	3%
2	9%	13%	5%	6%	2%	12%	2%	14%
3	24%	23%	20%	29%	17%	27%	22%	25%
4	39%	40%	35%	43%	39%	40%	33%	44%
5=Mission critical (now/future)	26%	20%	40%	20%	41%	18%	41%	14%
Base	135	60	40	35	41	93	58	77

Base=All respondents

Use of Modeling and Simulation

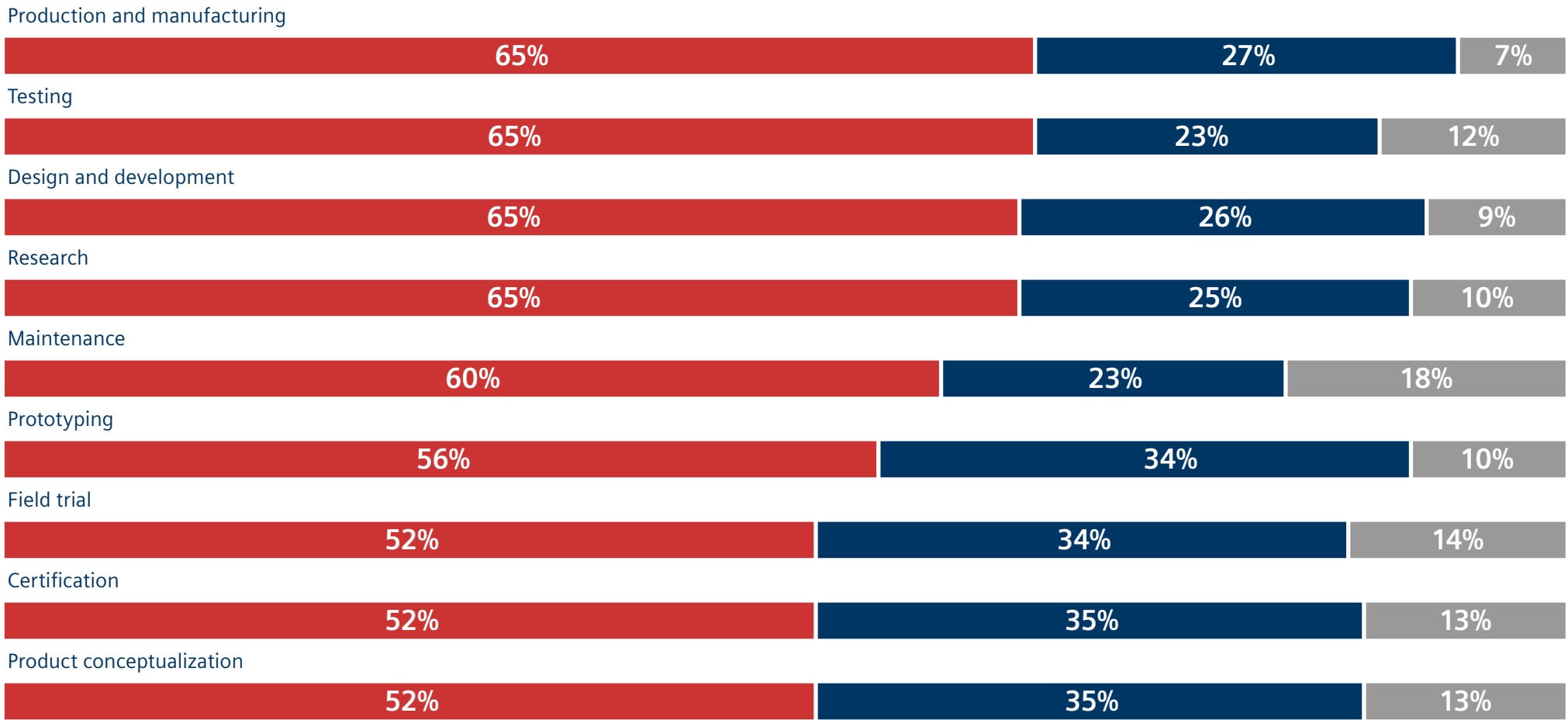
About two-thirds (65%) of respondents' companies currently use modeling and simulation technologies for **production and manufacturing, testing, design and development, and/or research.**

Uses for, benefits of, and most important types of modeling and simulation technologies

The current use of these technologies is as pervasive as it is diverse, including but not limited to: production and manufacturing, design development, testing, certification, product conceptualization, maintenance, research and field trials. Those not currently using these technologies plan to in the future.

Do you use modeling and simulation technologies for each of the following?

● Currently use ● Plan to use in the future ● No plans to use



Base: All respondents (n varies from 133 to 136).

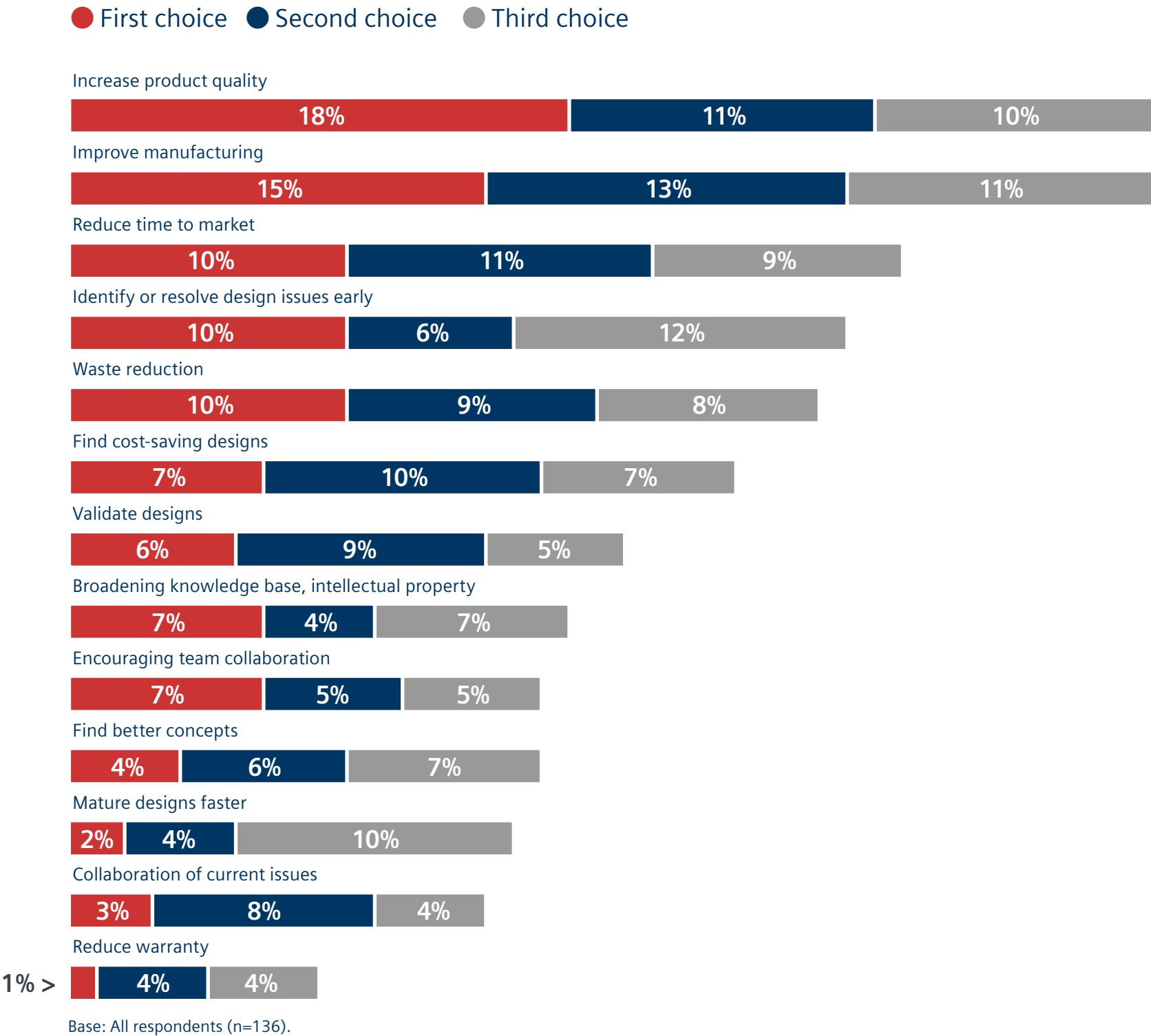


Benefits of Modeling and Simulation

Modeling and simulation technologies are considered most beneficial for **increasing product quality, improving manufacturing, and reducing time to market.**



What are the three most valuable business benefits for the use of modeling and simulation technologies?



Most Important Modeling and Simulation Technologies

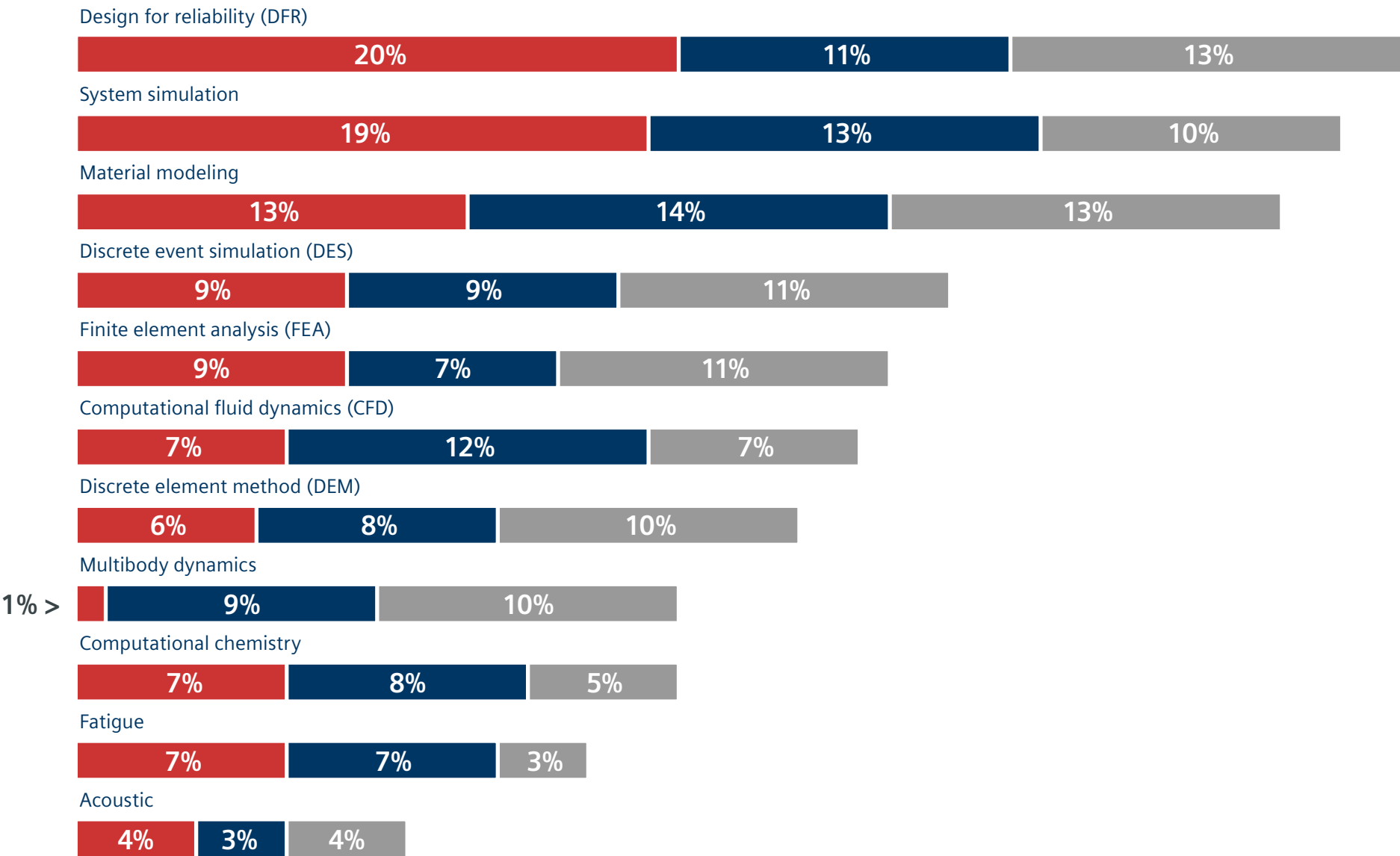
DFR, system simulation, and material modeling are considered the most important modeling and simulation technologies.

As diverse as the applications of modeling and simulation are the varieties of specific types of these technologies. When asked which are most important to industrial manufacturers, respondents indicated the top three being:

1. Design for reliability (DFR): Ensures that products and systems perform a specified function within a given environment for an expected life cycle.
2. Material modeling: Quantifies physical material properties, or the ability of a material to respond to physical influences.
3. System simulation: The process of experimenting with and studying how changes to characteristics of a complex system (or sub-system) impact the system as a whole.

What modeling and simulation technologies are most important to you?

● First choice ● Second choice ● Third choice



Base: All respondents (n=135).

The journey is well worth it and in the face of challenge, the right partner matters

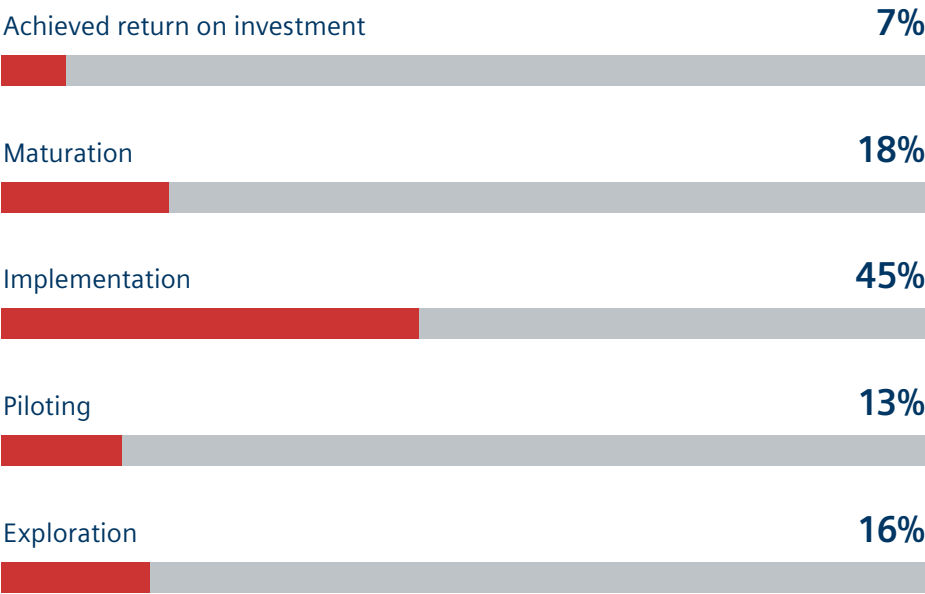
When it comes to the integration of—and return on investment—from these technologies, 45% indicated they were at the implementation stage, with just 25% reaching maturation or seeing a return on their investment. This, along with how important respondents see these technologies, suggests that the full potential of modeling and simulation has yet to be realized, and those further on their journey are already realizing bottom-line performance as a result.

The top barriers that stand in the way of deeper utilization include lack of qualified talent (52%), lack of training (37%), and lack of funding (34%). Talent and training come in this report and many others as a primary limit to the growth and success of the manufacturing industry, making investing in talent and training a top priority. It is a systemic issue, and the talent of the future needs to be put on the path as early in their education as possible. The rise of STEM programs, makerspaces, robotics programs and advanced vocational and technical training programs are on the rise, but they may not be enough to meet the demands of today, requiring diligent retraining of existing talent.

Modeling and Simulation Progress

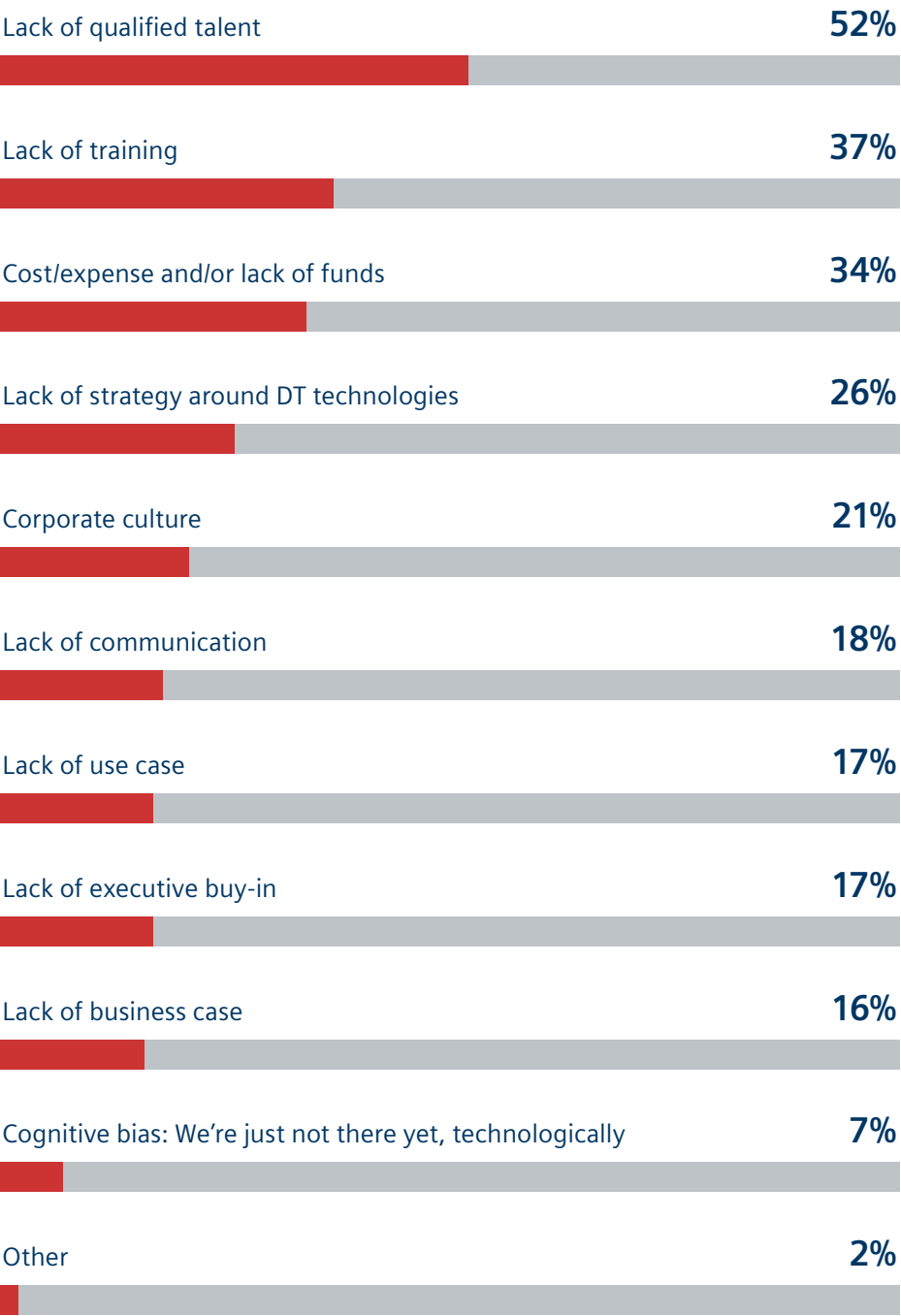
The largest percentage of respondents (45%) are currently in the **implementation stage** of integrating modeling and simulation technologies. A **lack of qualified talent** is the biggest barrier to a deeper utilization of the technologies.

At what stage are you as it relates to the integration of modeling and simulation technologies?



Base: All respondents (n=136).

What are the barriers in the way of deeper utilization of modeling and simulation technologies?



Base: All respondents (n=136); multiple answers allowed.



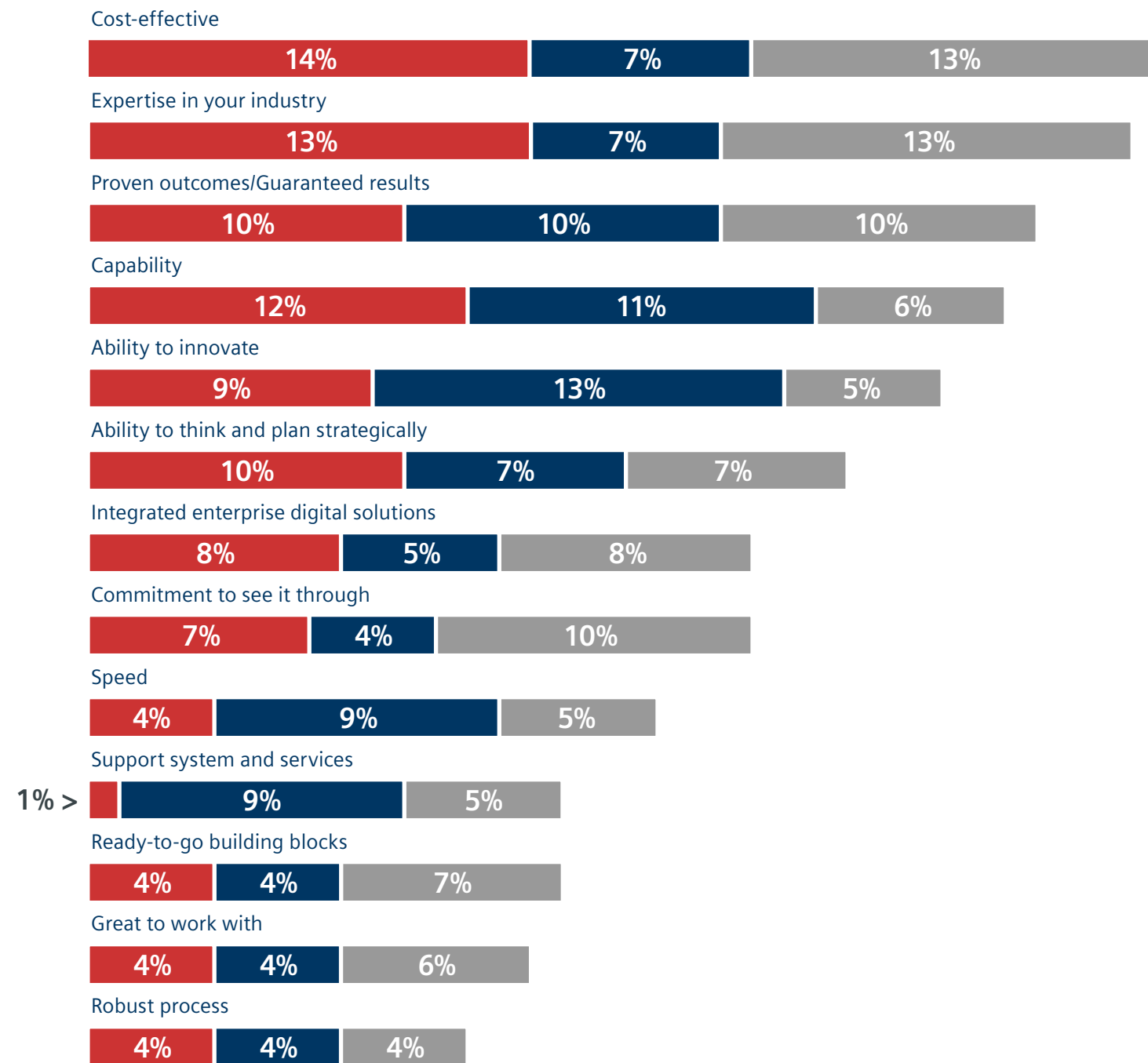
Perceived Value of Modeling and Simulation Partner Attributes

When looking for a partner to help with modeling and simulation solutions, respondents are most interested in companies with **industry expertise**, **cost-effective solutions**, and **proven results**.

With the capability, diversity and integration of these technologies increasing at an accelerating rate, it is critical to have the right, expert partners to help you and your team get the most out of them. Respondents indicated that the top attributes most sought in a partner include: 1) expertise in your industry, 2) cost-effectiveness, 3) proven outcomes, guaranteed results, 4) capability, and 5) ability to innovate.

If you were to hire a partner to help you with modeling and simulation solutions, what attributes would they have you feel would be most valuable?

● First choice ● Second choice ● Third choice



Base: All respondents (n=135).

Conclusion

Modeling and simulation technologies are instrumental when it comes to designing better processes and products, as well as lowering costs. They are currently a critical part of the design process and a key component of digital transformation. Most respondents who see these technologies as vital now and in the future are also the same respondents whose companies are outperforming their projections and outpacing their peers as it relates to digital transformation. It is clear that investing in these technologies helps to ensure the future is a long and prosperous one.

As these technologies advance, their use will also extend beyond products and processes and become more commonly used in other aspects of the industrial manufacturing industry, including supply chain design, and physical plant design. It is in the industry's best interest to not only stay on top of these technologies, but to find experts to help get the most benefit out of them, and plan for a future where their use will be increasingly ubiquitous.



Connect with someone about modeling and simulation:

[Contact Siemens Representative >](#)

If you'd like to learn more visit:

[www.plm.automation.siemens.com >](http://www.plm.automation.siemens.com)

SIEMENS **IndustryWeek.**