accenture

THE RACE FOR DIGITAL OPERATIONS TRANSFORMATION

The time for experimenting is over

Executive summary

It's been nearly a decade since the vision for Industry 4.0, the digitization of manufacturing, was announced with great fanfare at the Hanover Messe trade fair in Germany. This was followed by ambitious government programs backing the initiative in most industrial countries. What progress have manufacturers made in the past 10 years toward making that vision a reality?

New research from Accenture Strategy practice suggests not nearly as much as they could have—or need to. In fact, our study reveals that the average digital maturity of manufacturers' end-to-end operations overall is only **39 percent**, on a scale where 100 percent indicates all capabilities are deployed and rolled out. Most surveyed companies are past the proof-of-concept stage and are now in actual pilots with partial scaling up.

We discovered a number of key differences among the industries and countries included in our study. For instance, the average digital maturity of **upstream oil and gas, aerospace and defense, chemicals, and high-tech companies far outpaces that of enterprises in the life sciences and consumer goods and services industries**.

Not surprisingly, those mature industries are also more likely to be spending more to scale up their digital operations capabilities and seeing a greater return on their investment. We found similar **disparities among countries, with the United States and Singapore being the most mature on average**, spending the most, and generating the greatest value.

Our assessment also identified a small group of manufacturers that have separated from the pack. These companies, representing a cross-section of industries, illustrate how a deep commitment to digital technologies and solutions, combined with significant investment and an unwavering focus on key enablers, can create substantial and sustainable value.

Their experiences offer other manufacturers guidance on what it takes to accelerate their digital transformation and begin reaping the benefits of a more connected and intelligent enterprise.

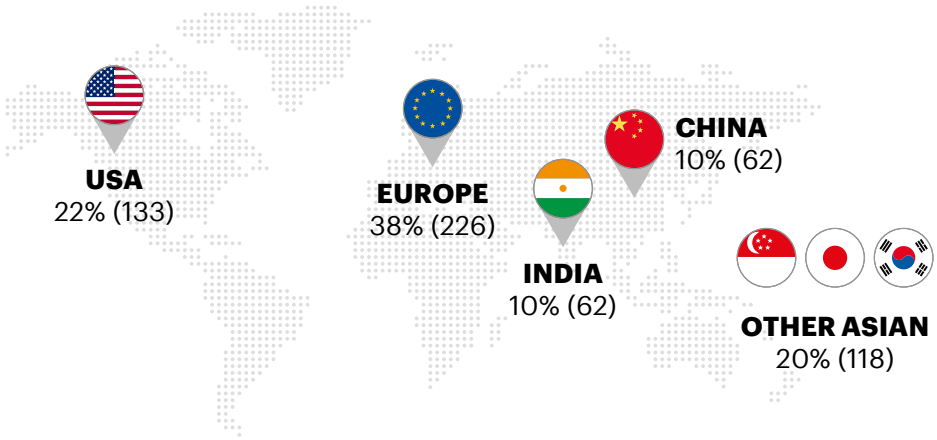
In the remainder of this report, we explore in more detail how mature manufacturers' digital operations capabilities are, what manufacturers have been spending on digital and the returns they're getting, and what enablers must be in place to successfully transform.

End-to-end Digital Operations Transformation is the reinvention of companies through advanced digital technologies to drive new levels of efficiencies, customer experiences, and sustainability across their engineering, manufacturing, and supply chain functions.

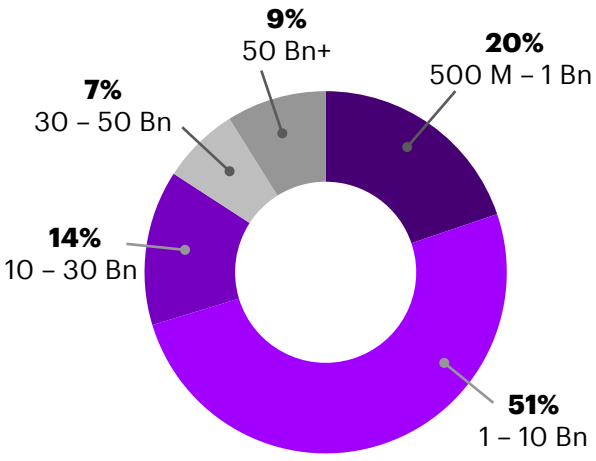
About the research

As part of our research, we surveyed 600 companies to evaluate the status of the digital transformation of end-to-end manufacturing operations globally.

COMPANY HEADQUARTER LOCATION (% and number of respondents)



REVENUES
(Yearly revenue 2019 in USD)



- Company panel revenue is between 500 M to 50 Bn+
- 80% of the company panel are above 1 Bn USD revenue

8 INDUSTRY SECTORS REPRESENTED BY THE RESEARCHED COMPANIES

- Oil & Gas
- Automotive
- Aerospace & Defense
- Industrial Equipment
- Chemicals
- High-Tech
- Life Sciences
- Consumer Goods & Services

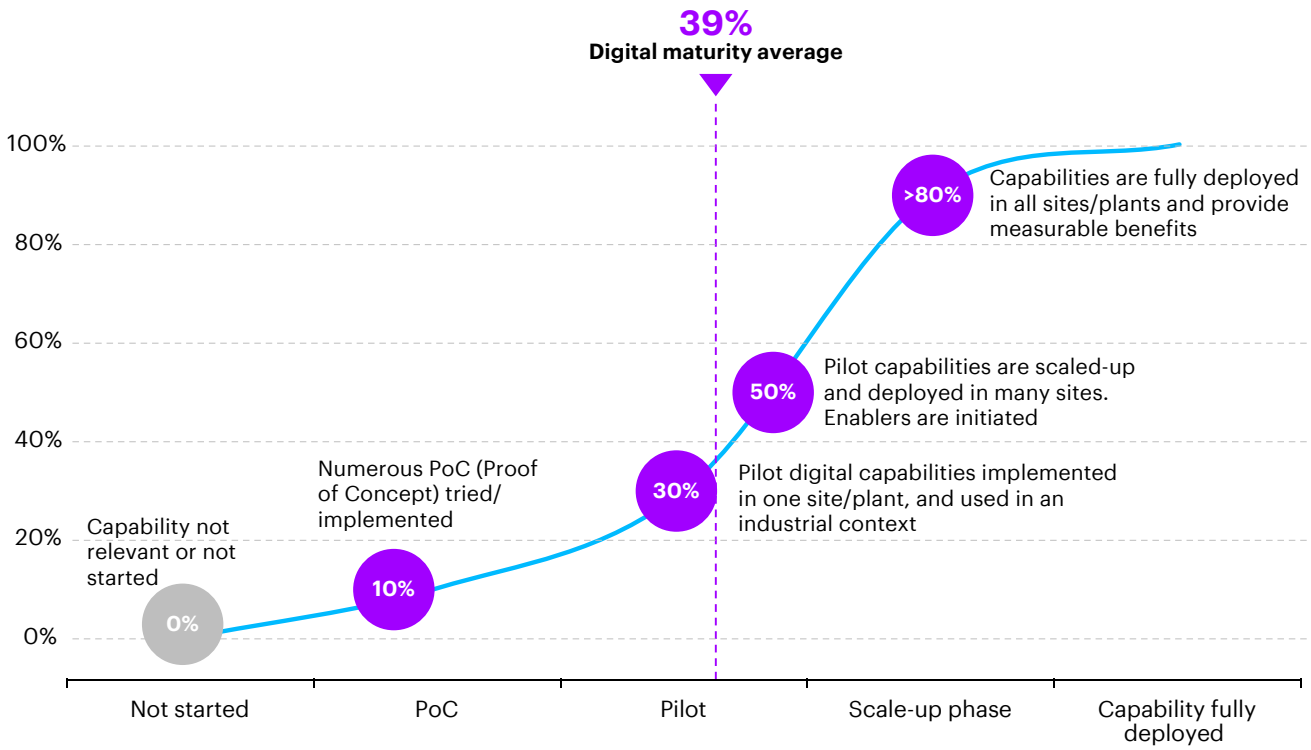
Digital maturity index

From PoCs to scaling up

To gauge end-to-end digital operations maturity, Accenture evaluated manufacturers on the extent to which they've deployed 40 key digital capabilities across their operations (Figure 1) using a digital maturity index.[1]

As mentioned, the average digital maturity across our panel is 39 percent (with 100 percent indicating full deployment), which means companies have completed pilots for some capabilities and have begun to scale up. The capabilities in bold in Figure 1 are the 11 that are being deployed most rapidly.

The fourth industrial revolution potential is still far from being realized.



[1] We created a digital maturity index that enabled us to evaluate the extent to which companies in our study were deploying the 40 key digital capabilities—from not started, to proofs of concept (PoCs), to pilots, to scaling up, to fully deployed.

Figure 1: The 40 key digital capabilities for operations

Domain	Capability	Q4	Q3	Q2	Q1
1 Design & Innovation	1.1 AI for product portfolio optimization			●	
	1.2 Feedback 360 across the product lifecycle				●
	1.3 Rapid prototyping (e.g. 3D printing)	●			
	1.4 AI based design tools (e.g. generative design)	●			
	1.5 AI/Analytics to identify design quality risks (e.g. DFMEA)			●	
	1.6 Smart costing tools with AI for design to cost		●		
	1.7 Smart project management tools	●			
	1.8 Smart learning tools to capitalize lessons learned		●		
2 Asset	**2.1 Analytics to assess quality problems/non-conformity**				●
	2.2 Analytics for predictive and/or prescriptive maintenance			●	
	2.3 Analytics to perform conditional maintenance			●	
	2.4 Analytics to self-optimize machine parameter and auto correct/smart guidance		●		
	2.5 Analytics to self-optimize utilization of available assets		●		
3 Workforce	3.1 Paper-less shop floor with wearables, tablets and devices		●		
	3.2 Use **digital workstations, instruction, alerts & poka-yoke**				●
	3.3 Support operators with cobots		●		
	3.4 Dynamic task allocation and activity planning		●		
	3.5 Use of AR/VR for training	●			
	3.6 Remote expert supporting using AR	●			
	3.7 Quality inspection automation using vision and AI		●		
	3.8 Use digital and collaborative dashboard for daily shop floor management			●	
4 Planning	4.1 Digital twins to simulate industrialization scenarios	●			
	4.2 Dynamic & digital **production planning and scheduling**				●
	4.3 Extended supply chain control tower			●	
5 Supply Chain	5.1 Flow and warehouse automation based on AGV and cobots	●			
	5.2 Digital tracking flows and inventories				●
	5.3 Goods track and trace of quality and conformity			●	
	5.4 Inventory optimization based on AI			●	
6 Collaborative Platform	6.1 Use connected product/asset solutions to detect in-services issues		●		
	6.2 Adjacent **digital services** around the products				●
	6.3 Use of blockchain to accelerate admin flows between customers and supplies		●		
	6.4 Collaborative platforms to share data with clients and suppliers				●
	6.5 Voice of Customers analytics to drive product decisions			●	
7 Foundation	**7.1 Digital platform**				●
	7.2 Data lake solutions (incl. cloud)			●	
	7.3 Digital Continuity Maturity				●
	7.4 Readiness for 5G	●			
	7.5 Digital roadmap governance	●			
	7.6 Digital acculturation programs	●			
	7.7 Data quality maturity	●			
	7.8 Data management governance				●
	7.9 Cybersecurity solutions				●

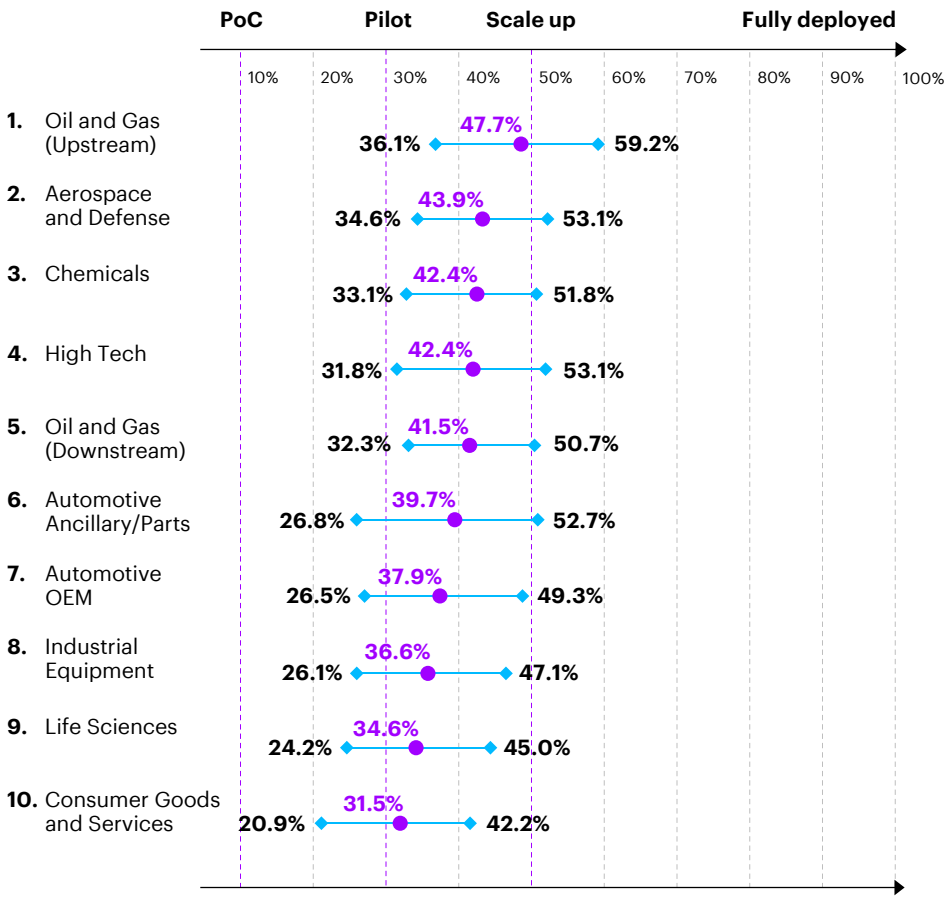
Q4 = quartile 4—least mature; Q1 = quartile 1—most mature. The capabilities in bold are the 11 that are being deployed most rapidly.

Digital maturity varies widely by industry (Figure 2). The most mature capabilities tend to be found where digital or data-driven solutions are critical to industry performance, or where there's significant potential for productivity increases.

Digital maturity lags in industries where there's little potential for productivity gains because operations are already lean, or where digital for operations isn't as high a priority as other concerns. For instance, highly efficient automotive OEMs today seem more focused on developing connected and electric cars than on digitizing their already automated assembly lines.

Another factor inhibiting digital deployment in certain industries is when the overall product cost represents a relatively small share of sales, thus reducing the impact of cost reduction on the P&L. This is the case for consumer goods or life sciences, where digital operations are more aimed at improving flexibility, personalization, and time to market than pure cost efficiency.

Figure 2: Digital maturity by industry

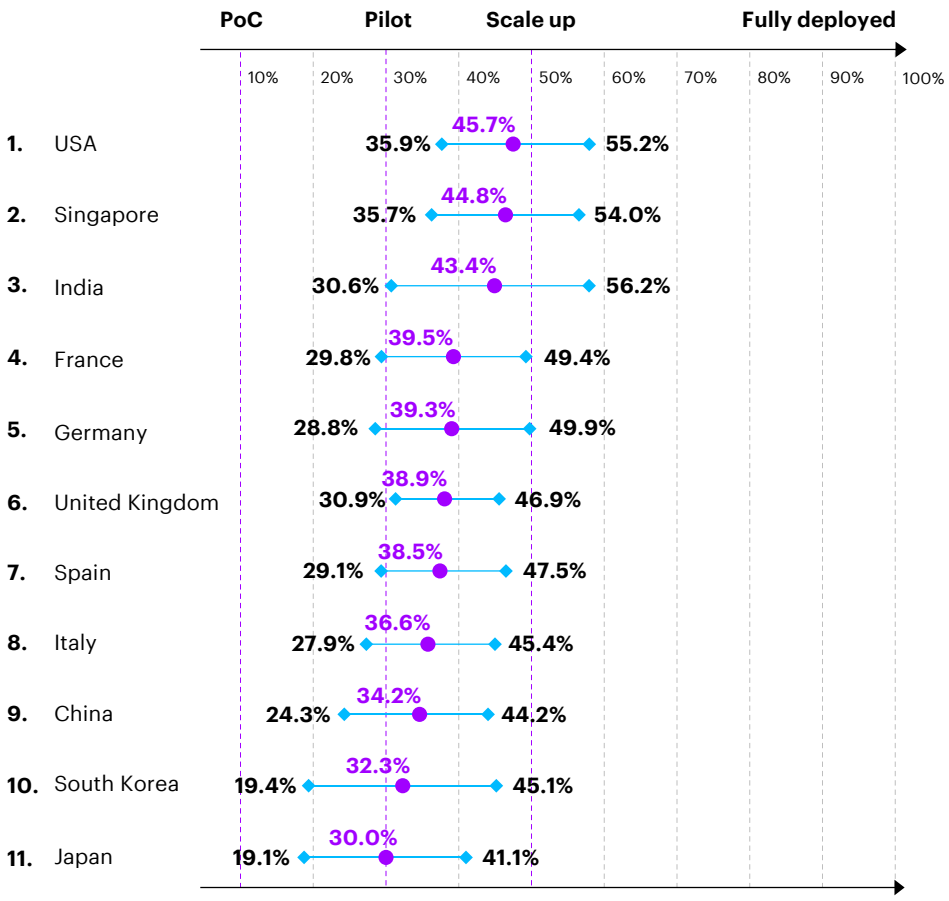


Individual countries also seem to be progressing at different speeds (Figure 3). Digital maturity has accelerated in countries in which government programs backing Industry 4.0 were launched early, such as Germany, the United States, and the major European countries (France, Italy, the United Kingdom, and Spain). In these countries, which rolled out national programs in the early 2010s, there's a relatively low industrial base, which allows faster movement, or the speed of digital adoption in general is high. The converse is also true: Countries with a large industrial base and established assets geared toward Industry 3.0 or late government support for Industry 4.0 are most likely to be lagging.

Japan's relative lack of digital maturity may be explained by the entrenched large and automated manufacturing base with excellent practices, which is likely slow to transform. Moreover, Japan's Industry 4.0 program wasn't truly visible until after 2015, which is nearly five years later than Germany. In China, lower digital maturity spread stems from a traditional labor-intensive manufacturing base with simple, low-feature products and globalized firms making adopting automation and lean practices a priority.

That said, all countries have enacted post-COVID-19 programs to support their industries (which typically includes initiatives to spur digital transformation), although numerous disparities exist in the extent of that support across countries.

Figure 3: Digital maturity by country



Investment and ROI

More begets more

When it comes to financial dimension, size truly does matter. We found a strong, inescapable correlation between the amount manufacturers invested in digital capabilities—both infrastructure and platforms—and the resulting impact on their operating income.

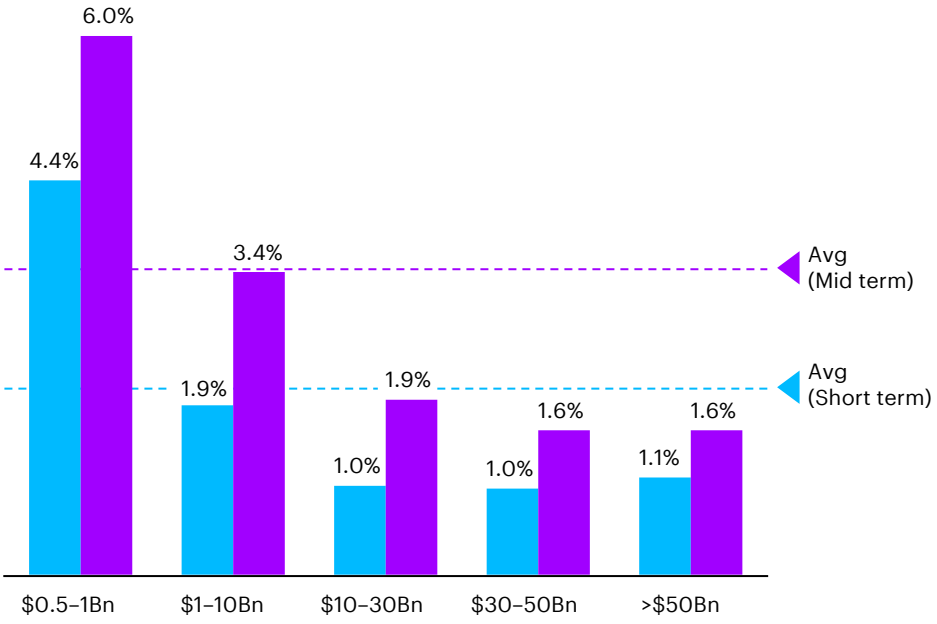
As shown in Figure 4, the scale effect on digital investments conveys an advantage to large companies, with those with the highest annual revenues enjoying a slightly larger average return. However, even smaller companies that invest substantially in digital (as a percentage of their overall sales) realize significant short- and mid-term savings, with an average mid-term impact of 4 percent lift on operating income (as a percentage of their overall sales).

Figure 4 outlines the planned level of annual investment in digital operations (covering digital platforms and infrastructure and all digital solutions) and the expected yearly savings. Short term denotes within the next three to five years and mid-term beyond five years. Digital operations is considered to be a portfolio of discrete measures that generate savings.

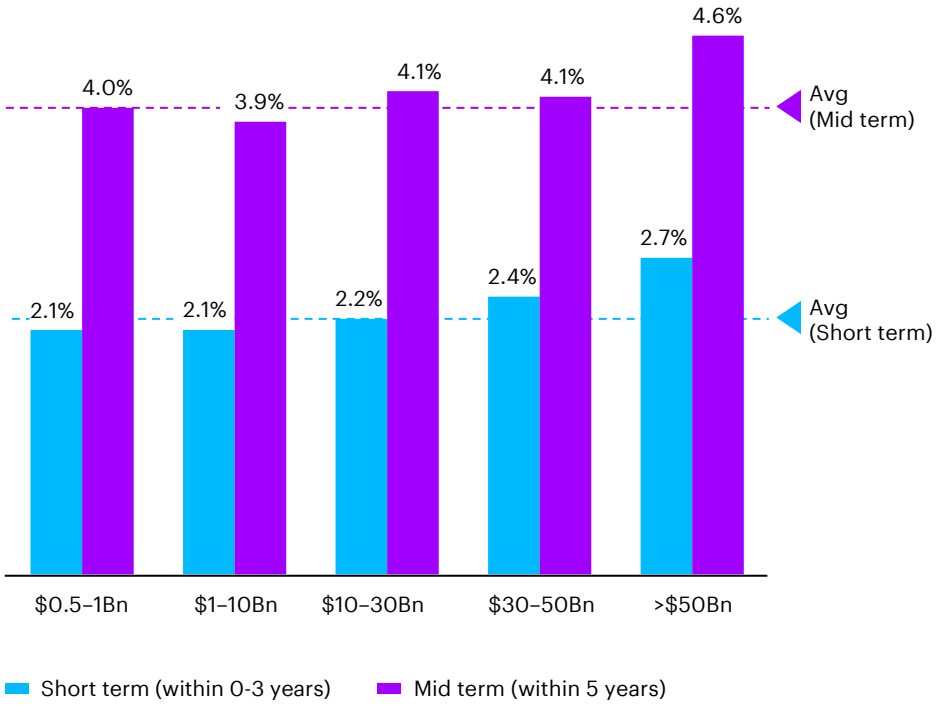
A good balance is when a specific year's savings fund the investments of the next set of solutions. In other words, done right, digital generates a rolling ROI of about one year, which makes the economics more attractive than classic IT programs with a long payback horizon.

Figure 4: Digital investment and ROI by company size

Digital Investments
Average Investment levels (% sales) vs. company sales range



Savings
Average operating income lift (% sales) vs. company sales range

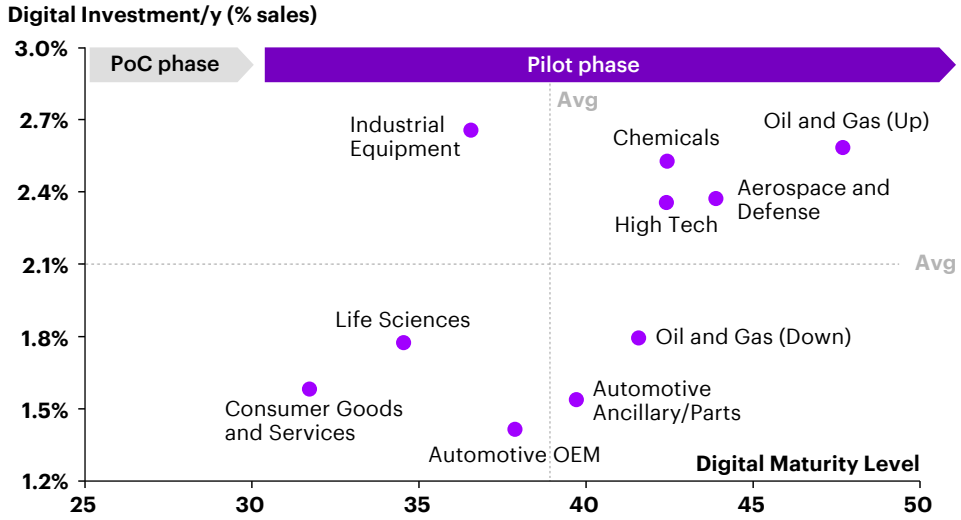


We also found a significant relationship between current digital operations maturity and planned level of investment or expected savings when considering our panel's industry (Figure 5) and country.

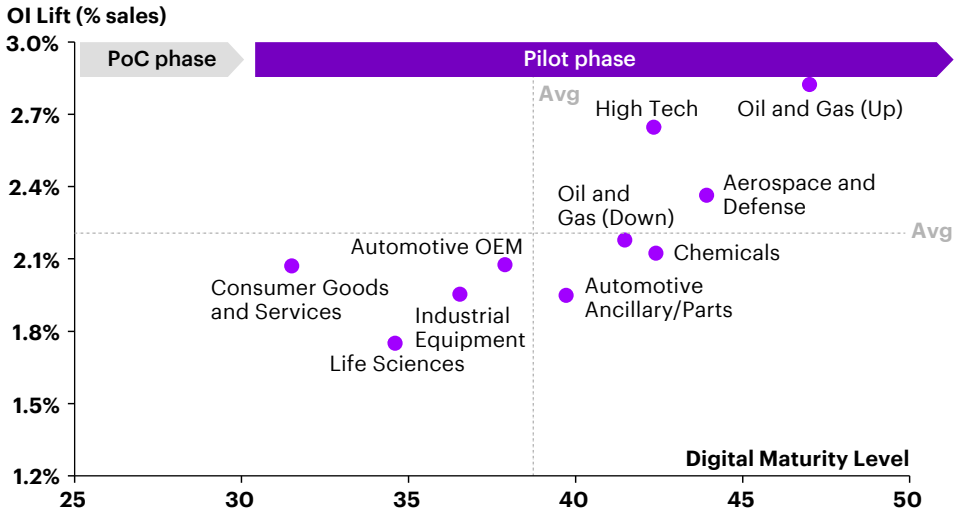
Those spending the most have the most mature digital capabilities and were most likely to reap greater benefits. These are, respectively, the upstream oil and gas, aerospace and defense, and high-tech industries; and the United States, Singapore, and India.

Figure 5: More mature industries are seeing higher returns as measured by operating income

More mature sectors intend to increase investments
Average digital investment (% sales) vs. Digital Maturity level



More mature sectors are seeing higher gains
Average operating income lift (% sales) vs. Digital Maturity level

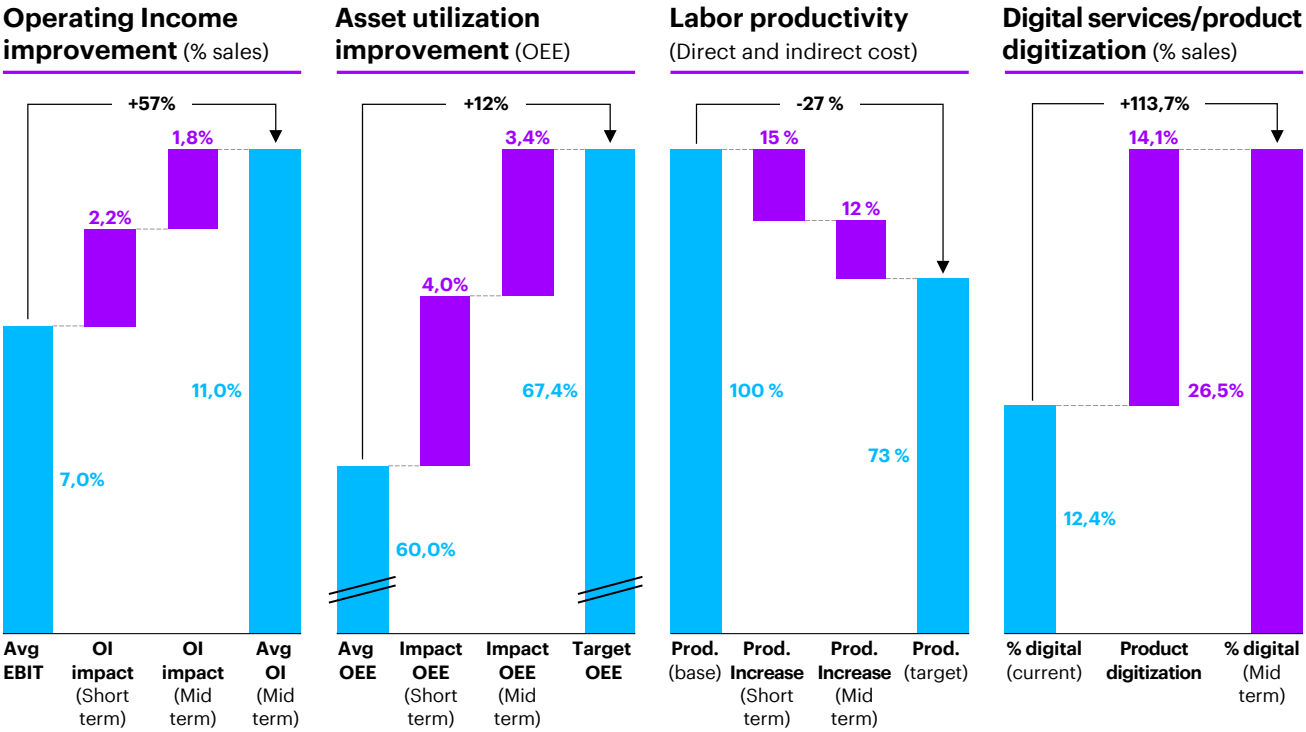


The overall economics provide a compelling argument in favor of a major commitment to digital. An average annual investment in digital representing 2.1 percent of sales in the short term and 3.4 percent in the medium term translates into massive boosts in operating income, asset utilization, and product digitization, and an equally impressive increase in workforce productivity (Figure 6). Furthermore, most players investing heavily in digital are seeing a significant top-line impact in the form of greater sales from connected services (such as connected products, connected services around the product lifecycle, and digital logistics offerings).

Overall, by boosting asset utilization, workforce productivity, and service, digital transformation significantly improves ROCE through higher EBIT (from greater cost efficiency and better pricing of digital offerings) and reduced capital employed (from greater asset utilization and lower inventory). This is why digital transformation of operations can be a major creator of shareholder value.

The bottom line: A complete digital transformation of operations requires a lot of money—but the payoff is equally substantial.

Figure 6: Value creation from an end-to-end digital transformation



- **Digital impact is doubling OI in the mid term**
- **Increasing savings with scale-up acceleration**

- **Digital is significantly increasing OEE and Asset rotation**
- **Thus ROCE expected to increase by +15% pts**

- **Labor (indirect and direct) efficiency to reach 27% productivity in the mid-term**

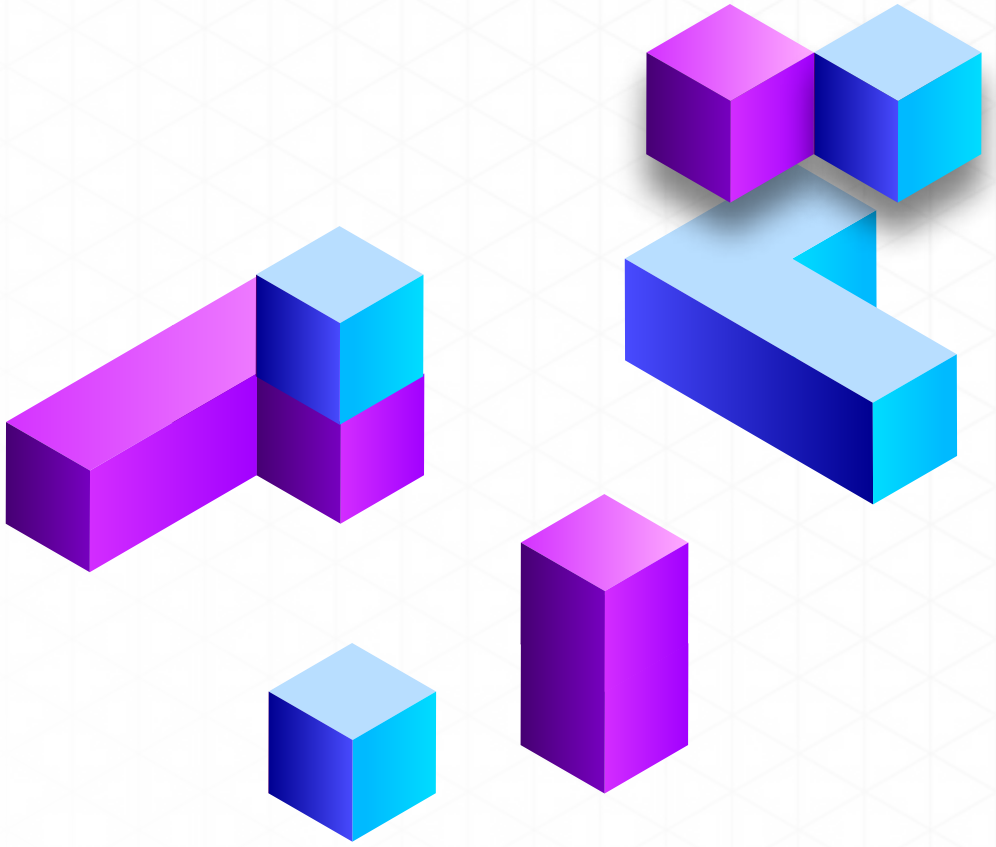
- **In the mid term, companies plan to more than double their product digitization**

Overall rolling ROI (*): 1 year

Change and enablers

Skills, leadership, and governance

In addition to being a big financial commitment, digital transformation isn't easy. Successfully embracing digital operations transformation at scale requires significant attention to the key enablers that contribute to digital readiness.

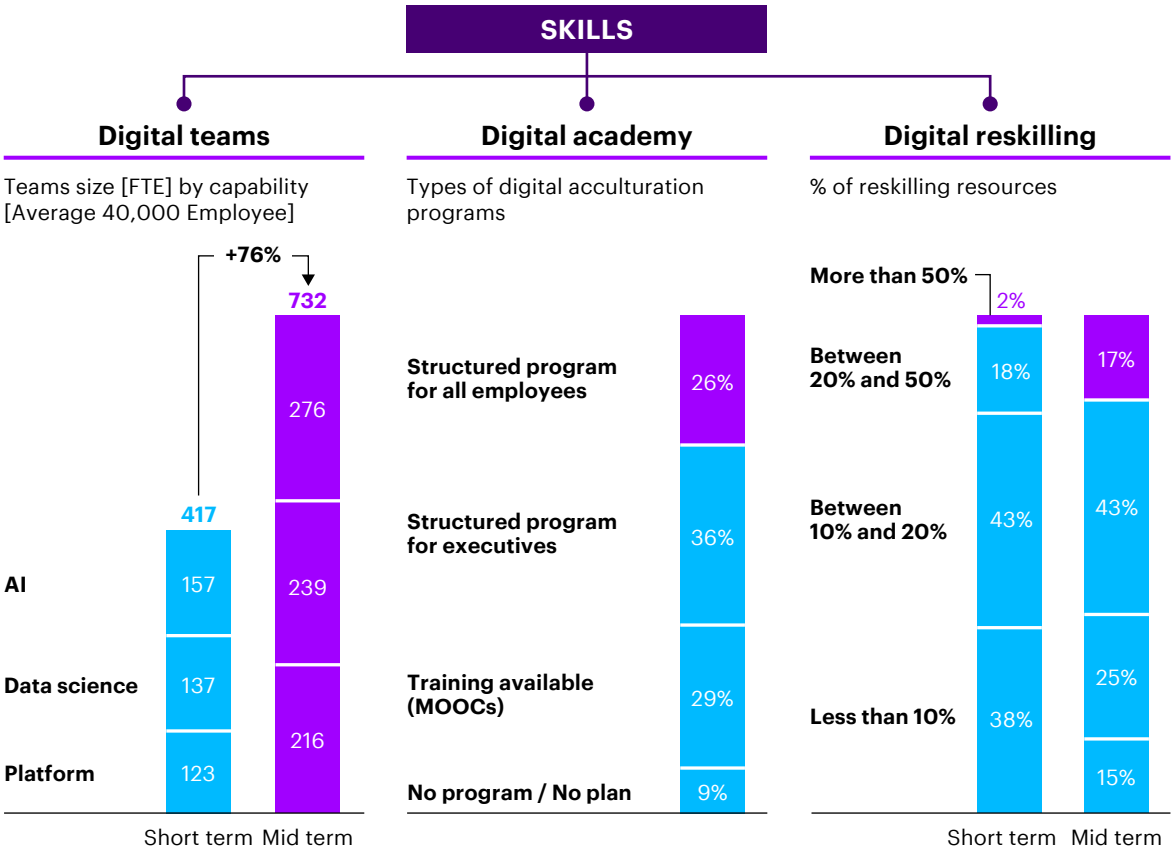


SKILLS

Digital capabilities must be staffed with the right number of people with the required skills.[2] Our survey indicates that these resources should represent around 1 percent of a company's staff in the mid-term and up to 1.8 percent in the future. As could be expected, larger companies in our study have larger teams with digital skills, on average, than smaller companies.

However, the latter look to be aggressive in building such skills, with plans to boost the average size of its digitally skilled team by 84 percent in the next five years—a much bigger increase than what's expected by the largest companies in our study (64 percent). Overall, companies plan to increase their digital capabilities teams by more than 75 percent (Figure 7A).

Figure 7A: Transformation readiness across key enablers



[2] For the purpose of our research, "skills" refers to relevant digital skills, including artificial intelligence, data science (analytics), user experience, and digital technologies programming, development, and implementation.

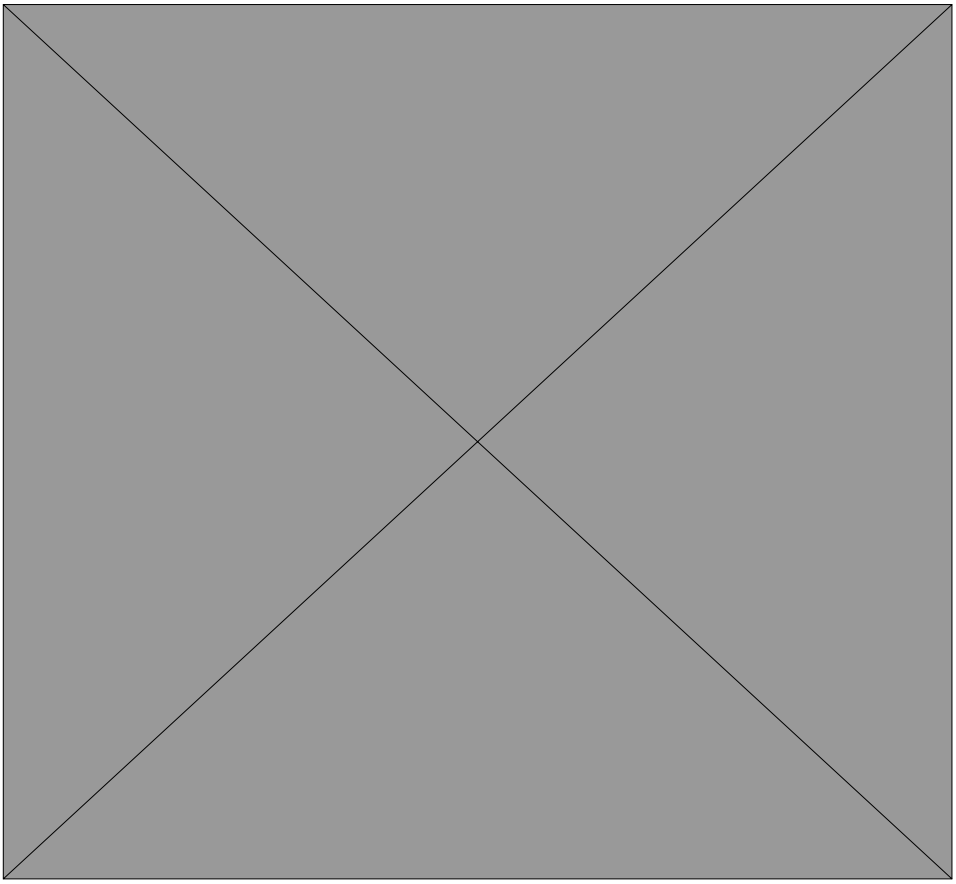
LEADERSHIP

Digital transformation can't be scaled if leaders don't embed it in their leadership role. Why? Because if leaders aren't fluent in using data-driven analysis to make decisions, digital transformations will fail to live up to their potential. Here, companies in our study have a lot of work still to do. Only 13 percent of companies have more than half of their leaders trained to use analytics to help drive their decisions (Figure 7B).

GOVERNANCE

Digital transformation must be driven at the highest level of governance possible, but that's not common among a majority of companies in our research. In only 39 percent of companies is digital transformation led by the executive committee or the board (Figure 7B).

Figure 7B: Transformation readiness across key enablers



Value Makers versus Traditionalists

Just like industries and countries, individual companies aren't progressing at the same pace or getting the same results. Our assessment identified a small group of companies—17 percent of our survey panel—that have highly mature digital operations capabilities that drive significant value (as measured by revenue and productivity).

These companies, which we dubbed Value Makers, have invested extensively in digital platforms and infrastructure (especially, as noted in Figure 8, those involving advanced digital capabilities) and, consequently, have enjoyed a substantial, positive impact on their operating income.

In contrast, a group we call Traditionalists, which comprises 39 percent of our panel, have weak digital capabilities (including basic, foundational ones, per Figure 8)—in large part, because they've invested comparatively less in them—and, accordingly, have seen scant improvement in operating income.

As Figure 8 indicates, Value Makers are winning the race for digital operations. Traditionalist still struggle to implement even rather fundamental capabilities, whereas Value Makers have moved beyond this stage and are now deploying more advanced capabilities.

The race for digital operations transformation is creating greater polarization between Value Makers and Traditionalists.

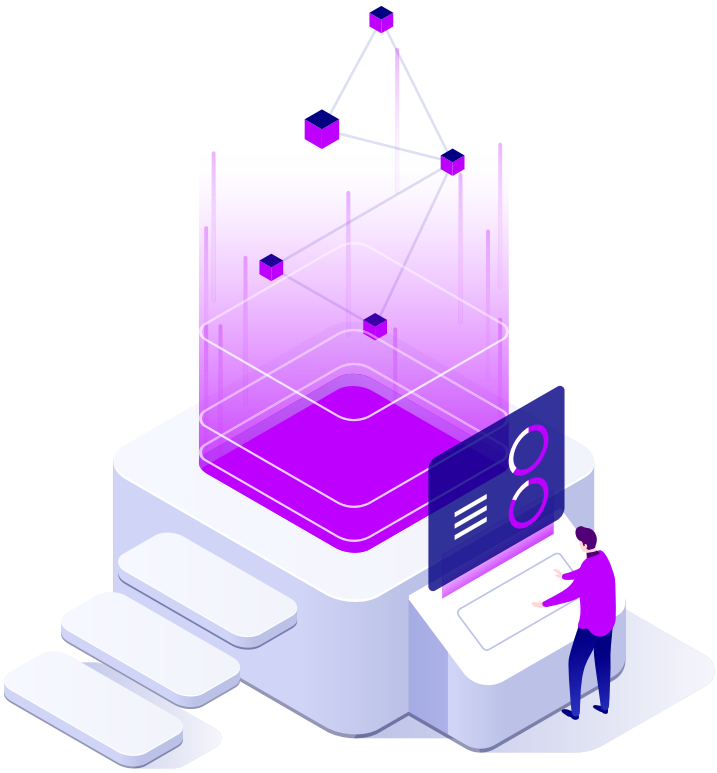
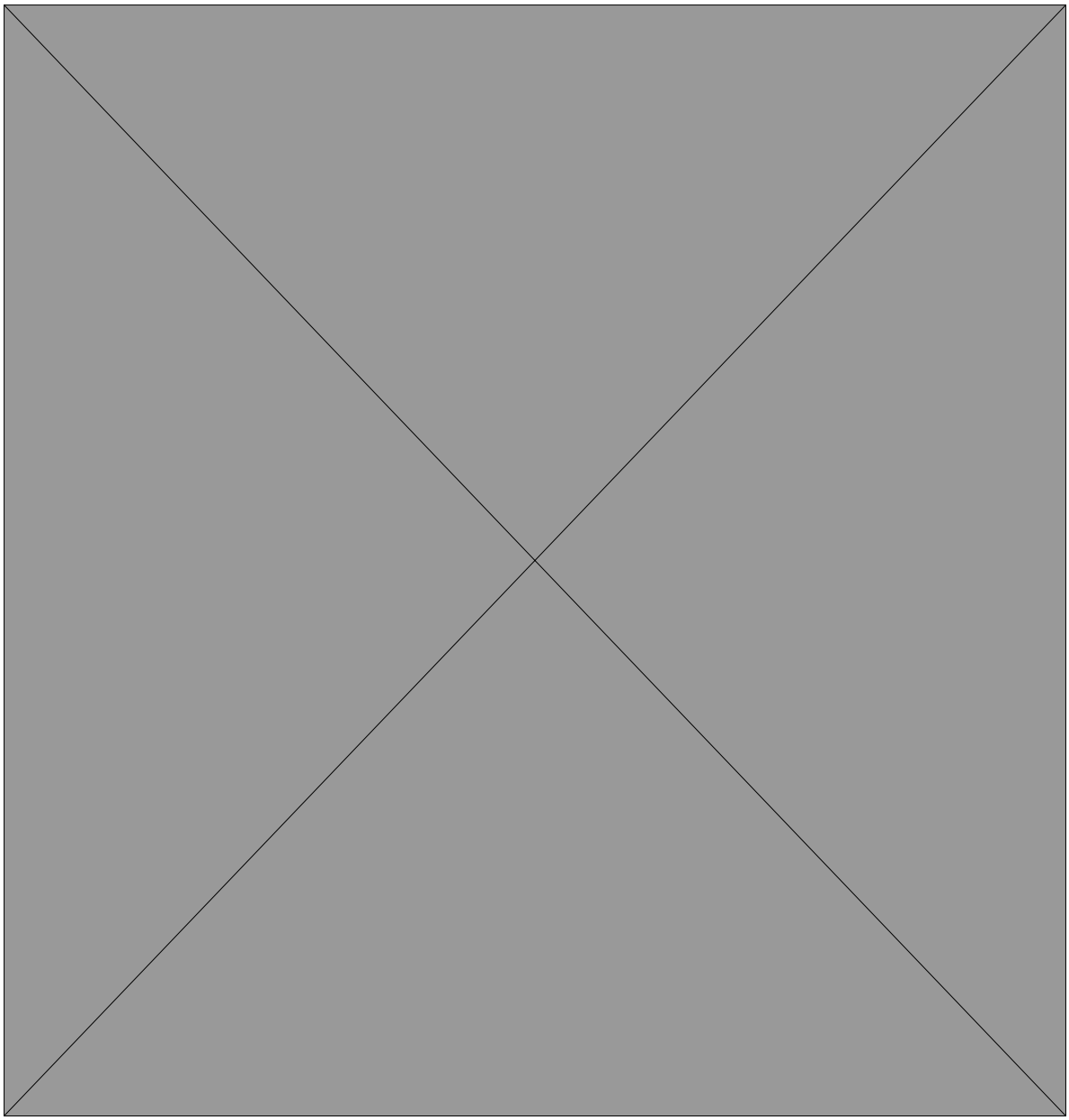


Figure 8: The differences between Value Makers and Traditionalists in deploying advanced and foundational capabilities



Value Makers are a great example of how betting big leads to out-sized returns. Value Makers are investing in digital, on average, at 3.1 percent of sales ($139 million) in the short term and 4.3 percent of sales ($440 million) in the midterm. Conversely, those figures for Traditionalists are 1.2 percent ($55 million) and 2.8 percent ($196 million), respectively.

What have Value Makers gotten for their money? Plenty. Value Makers lead Traditionalists by a large margin in improvements, both current and projected, in their overall operating income, Overall Equipment Effectiveness productivity, and direct and indirect headcount productivity. They're also far more likely to expect new digital services for customers will account for more than half their sales in next five years.

When it comes to digital readiness, Value Makers also set the bar. They're far more likely than Traditionalists to have large teams of people with key digital skills, be reskilling a majority of their employees in new domains, and have a structured digital academy in place for all employees (including leaders). Furthermore, most of Value Makers' leaders are trained to use analytics in their decision making, and the vast majority of Value Makers govern and steer their digital investments and transformation at the CXO level or above.

The upshot: While the proper investment is critical, no amount of money spent on digital solutions and technologies can overcome a substantial weakness in the right skills, leadership, and governance.

The time for experimenting is over

As our research shows, progress toward the vision of Industry 4.0 remains slow in most companies despite nearly a full decade having passed since its launch. Only a select group of manufacturers, the Value Makers, have forged ambitiously ahead and they're in the pole position to lead their respective industries for years to come. They are most likely better prepared to deliver extreme customer centricity and usage-based offerings, customizing locally to be in a better position to meet the customers' needs precisely. They can be extremely agile and masters of execution, continually capitalizing on opportunities to help boost their bottom and top lines. And they most likely have a strong and open culture that could enable them to attract and retain the best and brightest people. In fact, the gap between Value Makers and Traditionalists is so large that, without immediate and significant action and investment, many Traditionalists may never be able to catch up.

The question is, why are so many manufacturers still working on proofs of concept or pilots? Three key factors are inhibiting greater progress.

First, the vision for which solutions are best to apply within the different operations domains (e.g., product design, manufacturing, and supply chain) has taken time to emerge as manufacturers explored and experimented with various tools and trends. One year, cobotics was all the rage, then augmented reality, then IoT, then AI. The good news is that after years of learning about these technologies and associated solutions, industrial players now have a much better understanding of which are most relevant to their business. They also know the limits of those solutions—in other words, the dreaming phase is over.

Second, adopting new digital solutions across a real-world industrial enterprise is simply very difficult. Time and again we see examples of solutions deployed but no one using them. Why? Scaling up digital solutions requires instilling the accompanying new ways of working (meaning new standards), adapting solutions to the local environment (e.g., bug free and user friendly), and applying strong management attention to make it happen. It also requires a different scaling approach than what's commonly used.

Very often, manufacturers deploy specific digital solutions across sites or entities on a piece-by-piece basis—for example, implementing an analytics tool across all of an enterprise's factories. But in doing so, a company can't come close to seeing the full value of that isolated solution. To create the required change and value, manufacturers should concentrate on scaling up asset by asset—implementing a full digital solution set in one site. That engenders a true transformation of an asset, which not only creates far greater value, but also demonstrates the kind of results a company could achieve when it similarly transforms the enterprise as a whole.

Third, the reality is that Industry 4.0 still competes every day with "Industry 3.0." Why should manufacturers implement a sophisticated capability if they lack basic lean manufacturing practices, if capacity doesn't match demand, if more automation is needed, if basic operational excellence standards aren't used? This is the case for many industrial players, which can generate greater short-term savings by readjusting an asset, boosting automation, or right-sizing some teams than by implementing sophisticated digital solutions. An additional constraint is money—the investment companies can afford to fuel a transformation.

As opposed to business investments—for example, those that generate direct sales—digital investments are about modernization and capability upgrades. When a business isn't exactly firing on all cylinders, modernization takes a back seat to improving the immediate business outlook. That can't continue. Manufacturers should continue to set aside funds for digital transformation, just as they do for innovation, to prepare the company for the future. This decision must come from the executive committee or board, which must preserve this investment despite current business constraints or budget pressures.

The race for digital operations is truly well under way, and manufacturers that take too long to enter it are taking a big risk in the long term.

The race for digital operations transformation will create winners out of companies that tackled it and losers out of those that didn't. It's time for manufacturers to stop experimenting and begin scaling so they're not left behind.

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