

# *Industry 4.0: Building the digital enterprise*

## Industrial manufacturing key findings



**423**

*industrial  
manufacturing  
company  
executives  
interviewed in 26  
countries*

## Contents

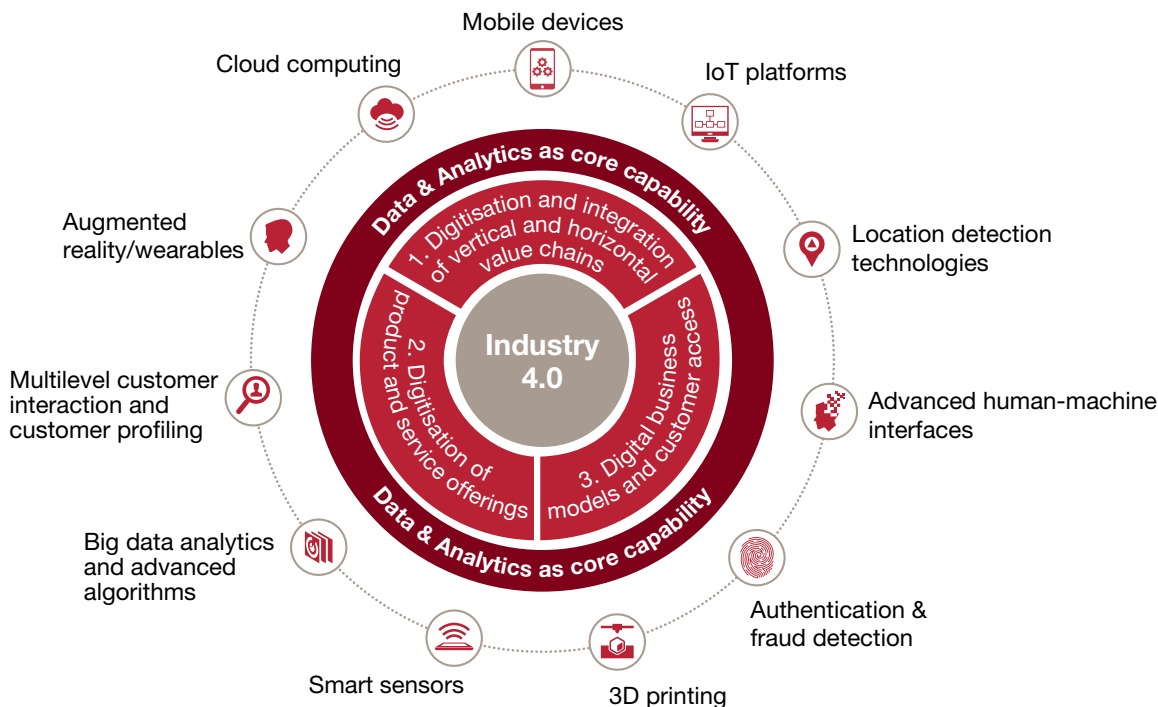
Overview	3
Key findings	4
Blueprint for success	11

PwC's 2016 Global Industry 4.0 Survey is the biggest worldwide survey of its kind, with over 2,000 participants from nine major industrial sectors<sup>1</sup> and 26 countries. It goes to the heart of company thinking on the progress of Industry 4.0. The study explores the benefits of digitising your company's horizontal and vertical value chain, as well as building your digital product & service portfolio.

## Industry 4.0 at a glance

We include a detailed description and definition of Industry 4.0 in the main global report on the survey. In summary, Industry 4.0 is being driven by digitisation and integration of vertical and horizontal value chains, digitisation of product and service offerings and the development of new digital business models and customer access platforms.

### Industry 4.0 framework and contributing digital technologies



<sup>1</sup> Aerospace, defence and security; automotive; chemicals; electronics; engineering and construction; forest, paper and packaging; metals; industrial manufacturing; transportation and logistics.

## Overview

Behind the scenes of the world's leading industrial products companies, a profound digital transformation is now underway. The industrial manufacturing sector is no exception. Companies are digitising essential functions within their internal vertical value chain, as well as with their horizontal partners along the supply chain. In addition, they are enhancing their product portfolio with digital functionalities and introducing innovative, data-based services.

- Industrial manufacturing companies plan to invest 5% of annual revenue in digital operations solutions over the next five years. And they are setting themselves ambitious targets for the level of digitisation and integration that can be achieved.
- Many companies are already producing machines to deliver on the vision of the connected factory, using the power of the internet to link machines, sensors, computers, and humans in order to enable new levels of information monitoring, collection, processing, and analysis. This is adding to the products and services that companies can offer their customers, helping them work

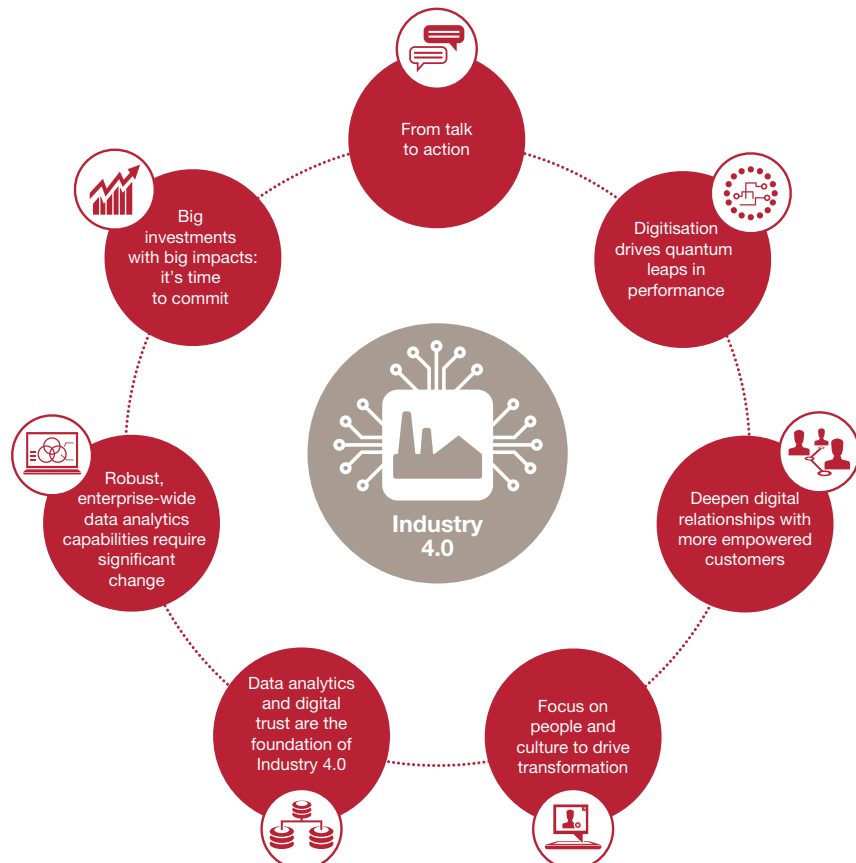
in collaborative ways in the design of future machines and their digital environment to boost performance.

- A number of technologies, including robotics, cobotics, 3D printing and nanotechnology, have direct relevance for many industrial manufacturing applications while other technologies, such as augmented reality, can enable manufacturers give customers real-time information and training at the point of use.

Some of these developments are maturing now. Others remain for the future. The rate of adoption of Industry 4.0 technologies by industrial manufacturing companies is accelerating fast. The digitisation, integration and automation opportunities offered enable companies to collaborate both internally and across their value chains in ways that can provide a step change in productivity as well as design and build quality. And they are opportunities that are increasingly important as companies seek to stay relevant as the era of digitally-connected smart infrastructure develops.

---

### Key findings from our survey research



## 01 Industry 4.0 has moved from talk to action

The buzz around Industry 4.0 has moved from what some had earlier seen as PR hype to investment and real results today. The industrial manufacturing participants in our survey plan to invest 5% of annual revenue in digital operations solutions over the next five years, in line with the level of investment reported across other industries that we surveyed. This investment is translating into increasingly advanced levels of digitisation and integration. Over a third of industrial manufacturing companies report they have already reached an advanced level of digitisation and integration and around three-quarters expect to be at such a level in five years' time (figure 1).

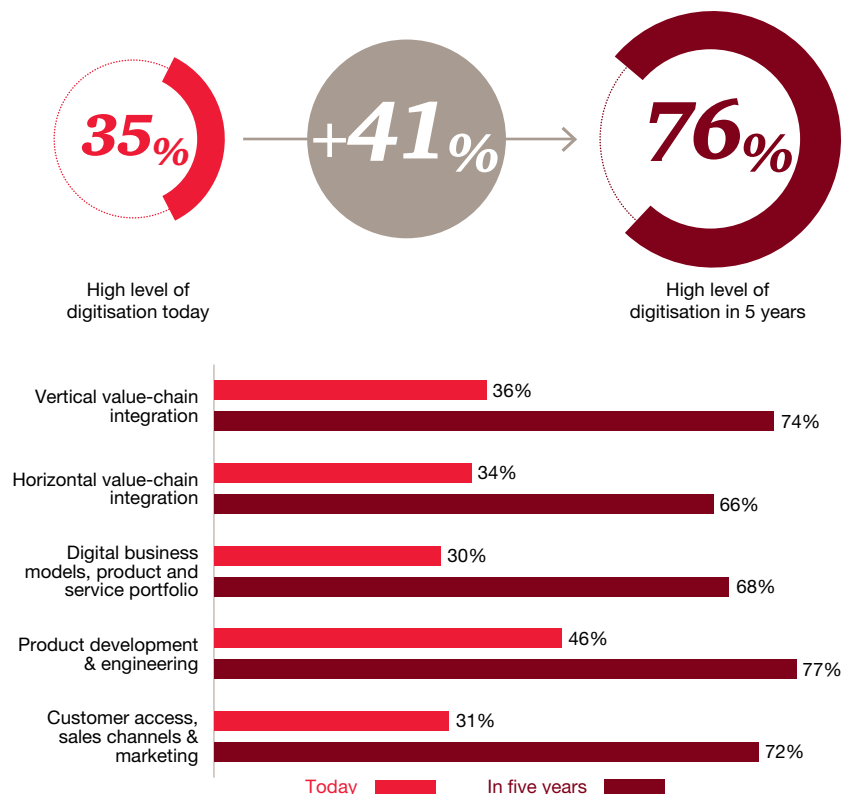
The level of progress is ahead of that reported across all sectors. Product development and engineering is the area where industrial manufacturing companies rate themselves as furthest advanced down the digitisation and integration road. Companies are already becoming adept at adding sensors and functionality to machines that can integrate with the broader digital environment, producing devices that provide more precision and can translate collected data into insights.

In common with other sectors, advanced digitisation and integration of the horizontal value chain, with suppliers, customers and other value chain partners, is progressing a little slower than with the vertical value chain. One for the characteristics of much of the industrial manufacturing sector is the longer timescales of the use of big machines by the sector's customers. Close collaboration in the timing and development of new machines and platforms will be important in ensuring that both suppliers and customers move in step with the pace of Industry 4.0 change.

# 46%

of industrial manufacturing respondents say they have already reached advanced levels of digitisation in product development & engineering

**Figure 1: Industrial manufacturing: Industry 4.0 is beyond the hype – it is has arrived at the strategic and operational core of many industrial manufacturing companies**



Shown: Percentage of industrial manufacturing companies reporting advanced levels of digitisation and integration

**Q: How would you classify the current level of digitisation and integration in the following areas in your company? What levels of digitisation and integration are you expecting in the next five years?**

## 02 Digitisation is driving quantum leaps in performance

Our survey respondents anticipate significant gains over the next five years from the implementation of Industry 4.0 initiatives. On average, companies across all the sectors that we surveyed expect to reduce operational costs by 3.6% per annum. Industrial manufacturing companies are similarly optimistic with cost-saving expectations exactly in line with the results from all the sectors we covered. Survey participants also expect additional significant revenue growth to flow from their digitisation and integration initiatives. Again, the expectations of industrial manufacturing companies are aligned with the overall survey results, with a projected revenue gain of 2.9% per annum.

These are substantial simultaneous revenue-adding and cost-saving gains. Gains of the magnitude uncovered by our survey have the potential to change the competitive landscape within a very short space of time, if they are on top of the continuous improvement gains that companies would expect to achieve regardless of Industry 4.0. If even half of the expectations outlined above are realised, some companies may find it difficult to compete. In an increasingly cost-competitive market, no industrial manufacturing company can afford to lose out in operational efficiency against their market peers. The next two to three years will be crucial for companies looking to catch up.

***If even half of the expectations outlined are realised, some companies may find it difficult to compete. In an increasingly cost-competitive market, no industrial manufacturing company can afford to lose out in operational efficiency against their market peers.***

**Figure 2:** High expectations of cost savings, increased revenue and efficiency gains (industrial manufacturing)

***Expected benefits from digitisation over the next five years***



Q: What benefits from digitisation do you expect in the next five years?

### 03 Deepening digital relationships with more empowered customers

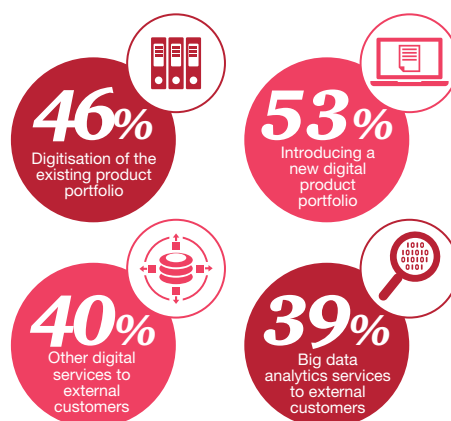
As Industry 4.0 develops, it will greatly enrich the opportunities to retain and grow the client relationship but it will also make the fight for the customer more intense. Clients and customers will be at the centre of the changes to value chains, products and services. Products and services will be able to be increasingly customised to customer needs, and many of our survey respondents say they plan to use data analytics to understand and meet these needs.

Most companies we spoke to are expecting to strengthen their digital offering to customers, either by digitising existing products or by developing new digital products. The opportunity is there not only to greatly increase the ability to respond flexibly and more rapidly to customer demands, but also to anticipate demands, helping customers get ahead of themselves in a range of predictive ways. Industrial manufacturing companies plan to expand their digital portfolio, starting with the digitisation of their existing offering but also expanding into new products and data services (figure 3).

**The opportunity is there not only to greatly increase the ability to respond flexibly and more rapidly to customer demands but also to anticipate demands, helping customers get ahead of themselves in a range of predictive ways.**

Already, industrial manufacturing companies are producing machines capable of producing multiple data points to deliver more precision and translate collected data into insights that, for example, help to determine the amount of voltage used to produce a product or to better understand how temperature, pressure, and humidity impact performance. Data analytics also opens up opportunities for new products and services, such as using information on machine performance to offer companies full machine and performance optimisation services as well as repair and maintenance services.

**Figure 3: Revenues from digitising the product and service portfolio will grow significantly in future (industrial manufacturing)**



Note: Industrial manufacturing companies achieving 10% or more additional revenue in the following areas over the next 5 years. Multiple answers possible

**Q: Which of the following new digital products or services do you plan to introduce and expect will generate more than 10% of your future revenue over the next 5 years?**

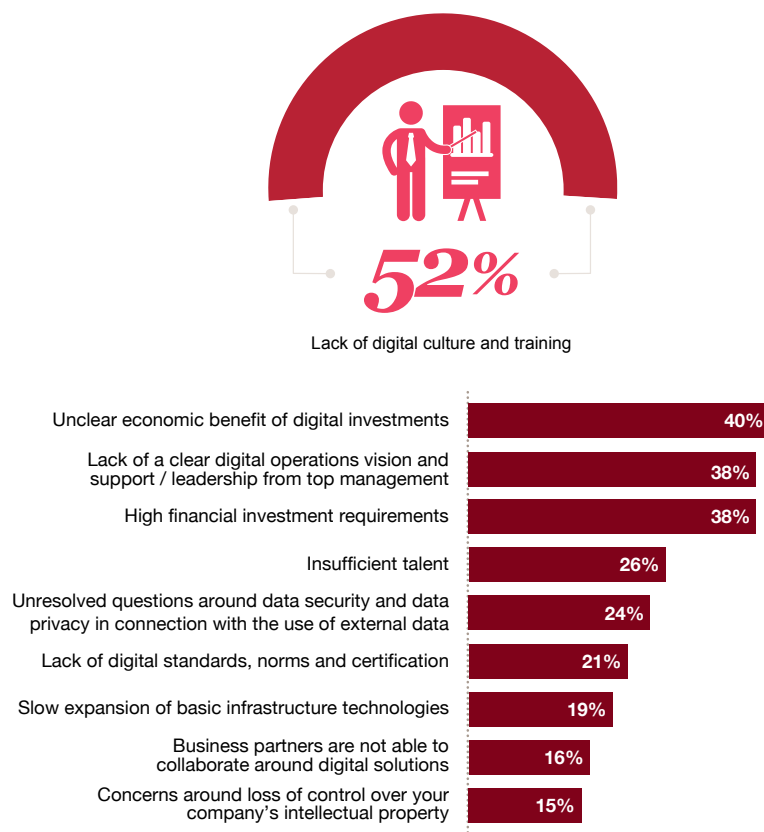
## 04 Focus on people and culture to drive transformation

Industry 4.0 has significant implications for the way in which a company chooses to organise itself and its delivery model. Companies will need to make sure staff understand how the company is changing and how they can be a part of it. From our interviews with industrial manufacturing companies, the biggest challenges revolve around internal issues such as culture, organisation, leadership and skills rather than external issues such as whether the right standards, infrastructure and intellectual property protection are in place or whether concerns about data security or privacy concerns can be overcome.

The absence of a digital culture and the right training was identified as the single biggest challenge by industrial manufacturing companies. Over half (52%) put it in their top three challenges. In this respect, they are in good company as changing the culture was a lead issue across all the sectors we surveyed.

For many companies, culture is linked closely with the need to have clear vision and leadership from top management about the direction of digital operations. This is also an issue for industrial manufacturing companies although, in contrast to most other sectors, it was eclipsed into second place by concerns that the economic benefits of digital investments still remain unclear. Clearly all these factors go hand in hand and one important way of establishing momentum in changing the culture will be for top management to communicate clearly the benefits that they see ahead and to ensure they are identified and celebrated as they are achieved.

**Figure 4:** Lack of digital culture and training is the biggest challenge facing industrial manufacturing companies



Note: Included as one of three possible responses

**Q: Where are the biggest challenges or inhibitors for building digital operations capabilities in your company?**



## 05 Data analytics and digital trust are the foundation of Industry 4.0

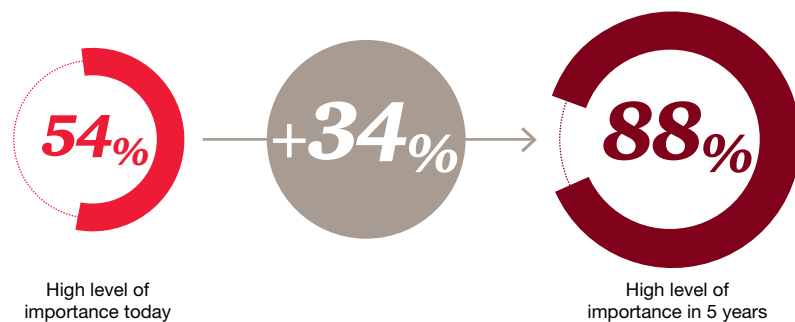
Data lies at the heart of the fourth industrial revolution, but the massively growing information flow brings little value without the right analytics techniques. The rapidly growing number of sensors, embedded systems and connected devices as well as the increasing horizontal and vertical networking of value chains result in a huge continuous data flow.

Data is coming from multiple sources, in different formats, and there is a need to combine internal data with data from outside sources. Expert and effective data analytics is essential to using data to create value. And with so many points of entry, companies need to take a rigorous, proactive approach to data security and related issues and work to build digital trust.

Our survey data show that many industrial manufacturing companies already understand the vital importance of data analytics. More than half (54%) view it as important or very important to their companies today, and this rises to 88% when they are asked to look five years ahead (see figure 5). These are higher percentages than the average for all the sectors we surveyed (50% now and 83% in five years' time), indicating that industrial manufacturing companies are more likely than companies in some other sectors to be putting data analytics at the heart of their decision-making.

**Only 20% of industrial manufacturing companies have advanced data analytics capabilities**

**Figure 5: Industrial manufacturing companies: in five years from now a significant importance will be placed on data analytics**



**Q: What significance does the gathering, analysis and utilisation of data for decision making have for your company?**

But there's still a long way to go before companies reach the level of sophistication needed to really drive Industry 4.0 applications. Only 20% of industrial manufacturing companies rate the maturity of their data analytics capabilities as advanced – a result that is only marginally above the 18% reported across all the sectors surveyed.

A key challenge is skills. It's an issue for all companies but is felt even more acutely by those in industrial manufacturing. Around half (51%) pinpoint lack of data analytics skills in their own workforce as a particular data analytics challenge compared with 53% across all the sectors we surveyed. And nearly three quarters (73%) cite increasing in-house data analytics technology and skill levels as the single biggest improvement route to boost their data analytics capabilities (versus 69% in the survey as a whole).



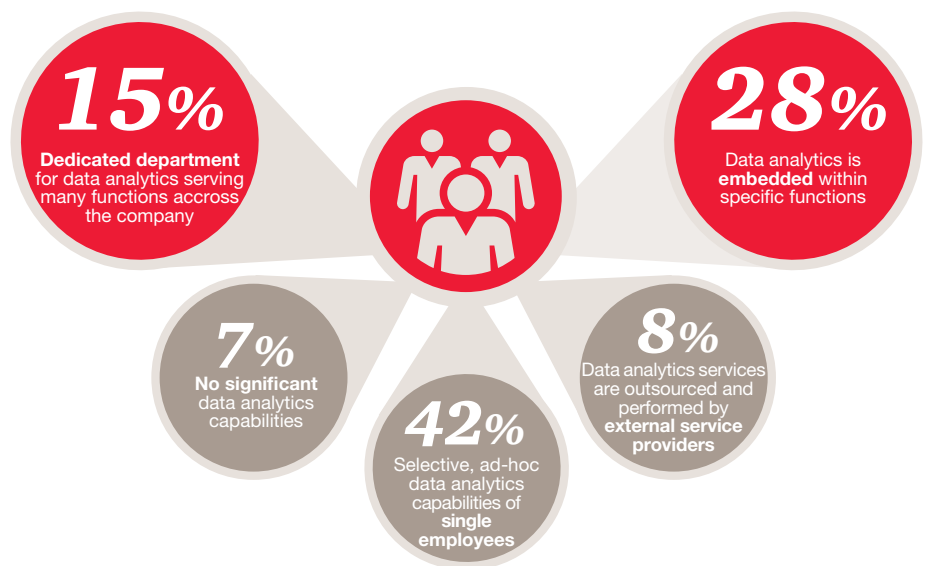
## 06 Robust, enterprise-wide data analytics capabilities require significant change

Another challenge lying in the way of companies establishing strong data analytics capabilities is getting robust organisation and governance frameworks in place. We found that many companies still have ‘ad hoc’ approaches to data analytics. Around half lack a structured approach to data analytics organisation and governance. Many (42% of industrial manufacturing companies) rely on the selective, ad-hoc data analytics capabilities of individual employees, while another 7% per cent have no significant data analytics capabilities at all (figure 6).

In contrast, less than a third (28%) have embedded data analytics into specific functions, giving themselves the flexibility and proximity to business knowledge to fully utilise the potential of data analytics. Another 15% of companies have a dedicated department for data analytics serving many functions across the company.

Across all sectors, our survey found that companies who consider they have advanced data analytics capabilities are much more likely to have pursued these two options – 43% have embedded their data analytics in specific functions and 24% have a dedicated department.

**Figure 6: Industrial manufacturing: organisation of data analytics capabilities**



**Q: How are data analytics capabilities organised in your company?**



## 07 Big investments with big impacts and rapid returns

Big investments are being made in Industry 4.0 initiatives. The prize for companies is a very special one – the prospect of achieving significant revenue gains while simultaneously reducing costs.

This golden prize of higher revenues and lower costs is in reach because the advanced connectivity and automation of Industry 4.0 allows companies to gather and analyse data from across a wider range of activities and from partners, suppliers, collaborators, end uses and end customers in ways that enable faster, more flexible processes to produce higher quality output, sometimes highly customised, at reduced costs. Heightened connectivity and automation gives companies the opportunity to add value to products and to develop new kinds of offerings to address their markets.

The pace at which industrial manufacturing companies expect to accrue benefits from Industry 4.0 investment leads around half (51%) to estimate a return on investment (ROI) timescale of two years or less (figure 7). Just over two fifths (42%) of companies anticipate a longer timescale of two to five years but few (6%) think that it will take any longer than five years for Industry 4.0 investments to pay for themselves.

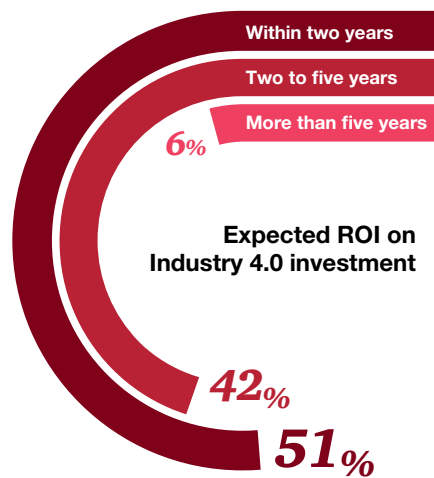
***It simply won't be possible for companies to achieve advanced digitisation without making a step change in investment, given the continued rapid progress anticipated by companies who are already leading***

### **Catching up is getting increasingly difficult**

Looking ahead, many of those who haven't invested significantly in the past two years plan to step up investment in the coming five years. That's one way to close the gap. But just over a third of companies still expect to keep their future investment relatively low. Some of these companies may be waiting for the 'perfect' technology. That's short-sighted. As we've already shown, the biggest challenge companies face isn't buying the right technology, it's transforming their people and culture. These require long-term change programmes.

It simply won't be possible for companies to achieve advanced digitisation without making a step change in investment, given the continued rapid progress anticipated by companies who are already leading. The investment required to catch up is likely to be too costly, and faster-moving companies will have a significant advantage when it comes to positioning their offerings as a "platform of choice" within digital ecosystems. Perhaps most importantly, companies who try to jump in too late will find that their internal cultures have lagged behind and no amount of advanced technology acquired later on will bring them up to speed.

**Figure 7: Industrial manufacturing: most companies expect Industry 4.0 investments to pay back within two years**



Note: Answers shown are rounded

**Q: Which return on investment period (ROI) do you expect from your digital investments?**

## Blueprint for success

To move forward with Industry 4.0, digital capabilities are all-important. These take time and concentration; a step-by-step approach is important. But move with deliberate speed, so that you don't lose the first-mover advantage to competitors.

### 1) Map out your Industry 4.0 strategy

Evaluate your own digital maturity now and set clear targets for the next five years. Prioritise the measures that will bring the most value to your business. Whether that means increased R&D spend or focusing on 3D printing, make sure these are aligned with your overall strategy. Make sure company leadership is ready and willing to champion your approach. Check out PwC's "maturity matrix" in our main global survey report for a tool that can help speed up this process.

### 2) Create initial pilot projects

Use them to establish proof of concept and demonstrate business value. Target a confined scope, but highlight the end-to-end concept of Industry 4.0. Not every project will succeed, but they will all help you to work in a cross-functional and agile approach with customers and technology partners – the new norm of the future. With evidence from early successes, you can also gain buy-in from the organisation, and secure funding for a larger rollout. Design pragmatically to compensate for standards or infrastructure that don't yet exist. Collaborate with digital leaders outside your organisation, by working with start-ups, universities, or industry organisations to accelerate your digital innovation.

### 3) Define the capabilities you need

Building on the lessons learned in your pilots, map out in detail what capabilities you need to achieve

## Blueprint for digital success



your vision. Include how enablers for Industry 4.0, like an agile IT infrastructure, can fundamentally improve all of your business processes.

Remember to develop strategies for attracting people and improving processes as well as for implementing new technologies. Your success with Industry 4.0 will depend on skills and knowledge. Your biggest constraints may well be your ability to recruit the people needed to put digitisation into place.

### 4) Become a data virtuoso

Consider how you can best organise data analytics; cross-functional expert teams are a good first step. Later these capabilities can be fully embedded in your functional organisation. Learn to get value out of data by building direct links to decision-making and to intelligent systems design. Use the data to improve products and their use in the field to offer and build new service offerings. Think big, but start small, with 'proof of concept' projects.

### 5) Build a digital enterprise

Capturing the full potential of Industry 4.0 often requires company-wide transformation. Look to set "tone from the top", with clear leadership, commitment and vision from the C-suite and financial stakeholders. Foster a digital culture: all your employees will need to think and act like digital natives, willing to experiment with new technologies

and learn new ways of operating. Remember that change doesn't stop once you've implemented Industry 4.0. Your company will need to re-invent its capabilities at faster rates than in the past to stay ahead of the game.

### 6) Actively plan your digital ecosystem

Develop complete product and services solutions for your customers. Use partnerships or align with platforms if you cannot develop a complete offering internally. You may find it difficult to share knowledge with other companies, and you may prefer acquisition. But look for ways to bridge this gap – perhaps with technical standards – so that you can profit from being part of platforms that you don't fully control.

Real breakthroughs in performance happen when you actively understand consumer behaviour and can orchestrate your company's role within the future ecosystem of partners, suppliers and customers, integrating this with the manufacturing plant of the future.

Don't buy the hype. Buy the reality. Industry 4.0 will be a huge boon to companies that fully understand what it means for how they do business.

---

## **Contacts**

### **Barry Misthal**

Global Industrial Manufacturing Leader

+1 267 330 2146

barry.misthal@ch.pwc.com

### **Dr. Reinhard Geissbauer**

Head of EMEA Industry 4.0

Digital Operations Team

+49 170 939 1263

reinhard.geissbauer@strategyand.de.pwc.com

### **Jesper Vedso**

Global Industrial Products Industry 4.0 Champion

+45 3945 9144

jrv@pwc.dk

### **Stefan Schrauf**

Head of PwC Strategy& Industry 4.0 Team

for Germany

+49 895 790 5317

stefan.schrauf@strategyand.de.pwc.com

[www.pwc.com/industry40](http://www.pwc.com/industry40)

---

At PwC, our purpose is to build trust in society and solve important problems. We're a network of firms in 157 countries with more than 208,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at [www.pwc.com](http://www.pwc.com).

This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors.

© 2016 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see [www.pwc.com/structure](http://www.pwc.com/structure) for further details.