

Industry 4.0: Building the digital enterprise

Metals key findings



157

*metals company
executives
interviewed in 26
countries*

Contents

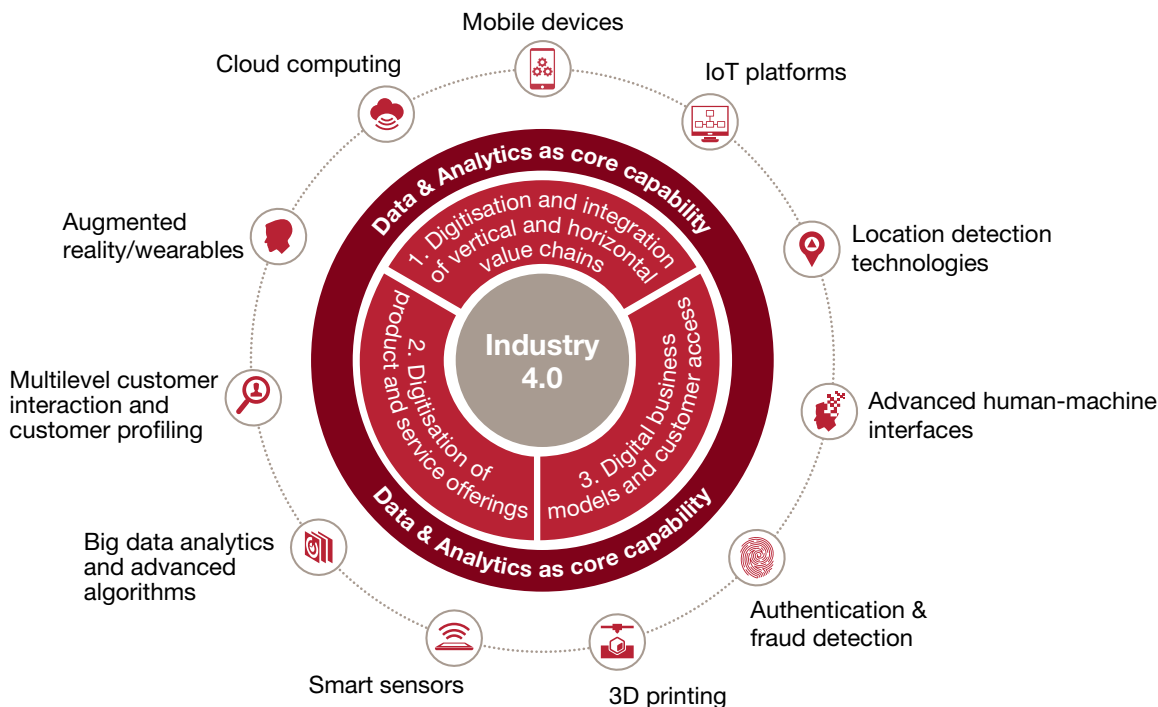
Overview	3
Key findings	4
Blueprint for success	11

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 sectors¹ 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



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

Overview

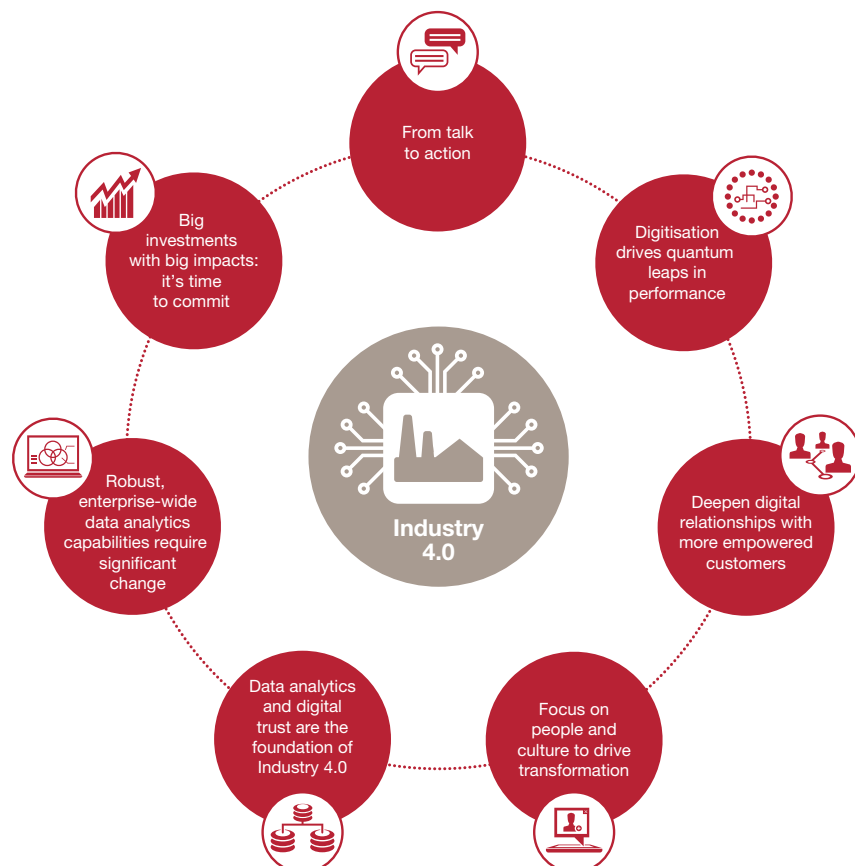
Behind the scenes of the world's leading industrial and manufacturing companies, a profound digital transformation is now underway. The metals sector is no exception. Companies are digitising essential functions within their internal vertical value chain, as well as with their horizontal partners along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

- Metals companies in our survey plan to invest 4% of annual revenue in digital operations solutions over the next five years. They are setting themselves ambitious targets for the level of digitisation and integration that can be achieved. Nearly two-thirds (62%) expect to reach an advanced level of digitisation and integration within the next five years.
- Digitisation has moved from being a 'nice to have' or augmenting capability for metals companies to something that is now vitally important for differentiation and becoming a disruptive force. It is delivering supply chain agility, deeper process understanding and higher production utilisation. Companies are planning for a future where much greater horizontal supply chain integration with customers and suppliers is possible across the whole product life cycle.

- Automation is combining with data analytics to enable much higher flexibility as well as more efficiency in production. Algorithms are linking the physical properties of the materials with production costs and plant constraints to improve efficiency. Processes that were previously separated are now being integrated, leading to reductions of heat loss, energy consumption, throughput time, inventory as well as better price optimisation.

Many of these developments are happening now. Others remain for the future. The vision is for digitisation to encompass the entire value chain with real-time data linkages upstream to suppliers and downstream to customers and beyond to encompass after-service as well as end of product life management. 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 metals participants in our survey plan to invest 4% of revenue per annum in digital operations solutions over the next five years, just short of the 5% level of investment reported across all the industries that we surveyed.

This investment is translating into increasingly advanced levels of digitisation and integration. Nearly a third of metals companies report they have already reached an advanced level of digitisation and integration and more than two thirds expect to be at such a level in five years' time (figure 1). Supply chain integration as well as order management and forecasting are key focus areas for digitisation investment among steel companies. Such investment is also particularly relevant in the downstream distribution segments and for non-ferrous metals such as aluminium producers, which have a higher automotive or packaging industry exposure.

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. Greater horizontal integration offers the prospect of coordination of orders, materials flow and production data, with all companies along the value chain being able to add their own value-adding steps. But to get there, companies have to get their vertical integration done first, starting at the heart of their metallurgical, rolling and finishing processes.

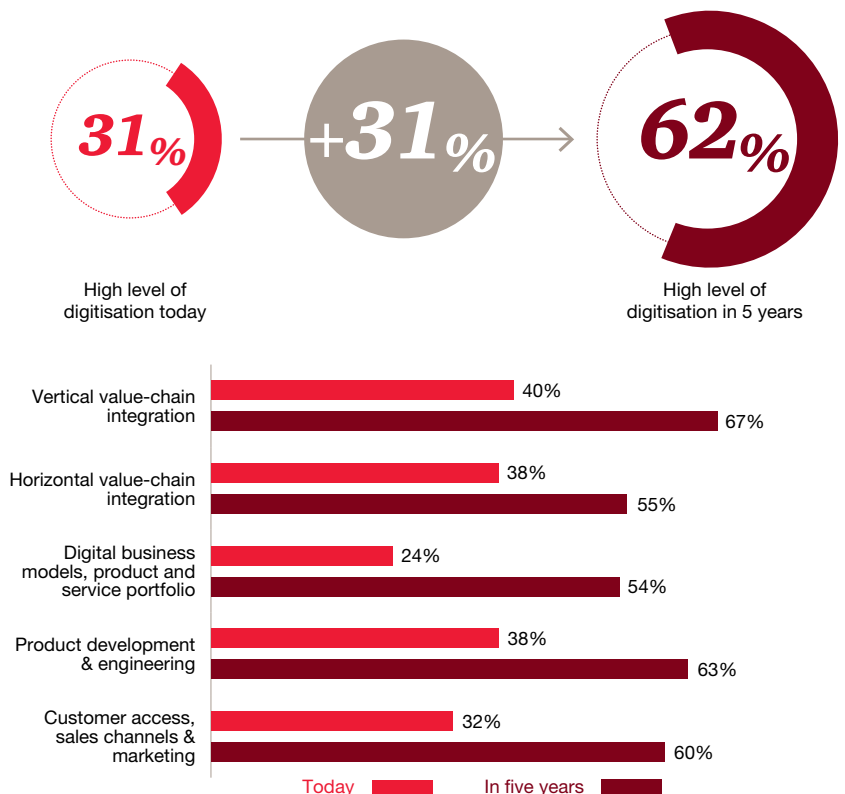
Metals companies in our survey expect product development and engineering to be the area where they are furthest advanced in five years' time in terms of their level of digitisation and integration (figure 1). Product development and engineering is being increasingly integrated with end-customer design requirements. Step changes in data analytics are being used by metals companies to optimise the production process in real time. For example, the reduction of the carbon content in the converter at integrated steel plants requires very sensitive management of time, gas, heat and other recipe parameters. The addition of big data analytics capabilities to handle the information coming from sensors is allowing companies to have much deeper understanding of metallurgical processes. The results include the minimisation of thermal losses, increased productivity and optimised temperature forecast accuracy.

Digitisation advances are also extending outwards from production all the way through to the customer. Initiatives such as collaborative demand planning, for example, allow customers and producers to jointly sense and rapidly respond to varying demand. Indeed, three fifths of metals companies report that they expect to have an advanced level of digitisation and integration in their customer interface by 2020. And, although it is more challenging, over half (55%) expect horizontal value chain integration with customers and suppliers to reach a similarly advanced stage.

67%

of metals respondents say they expect to reach advanced levels of digitisation in their vertical value chains in five years' time.

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



Shown: Percentage of 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. Metals companies are similarly optimistic, with only a marginally smaller projection for cost savings (figure 2).

Survey participants also expect significant additional revenue growth to flow from their digitisation and integration initiatives. Again, the expectations of metals companies are only slightly less ambitious than those of companies in all the sectors covered in the survey. They anticipate a revenue gain of 2.7% per annum compared to 2.9% in the survey as a whole.

These are significant 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 metals 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.

Metals companies expect significant additional revenue growth to flow from their digitisation and integration initiatives.

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

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 increase the opportunities to retain and enrich the customer 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 them.

Most companies we spoke to are expecting to strengthen their digital offering to customers, either by digitising existing products (e.g. adding quality information or specification) or by developing new digital products (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.

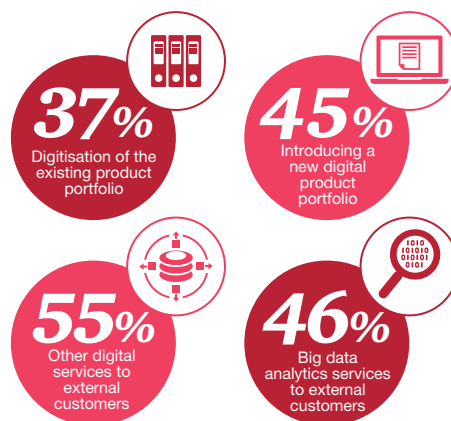
The emphasis is on new services rather than just digitisation of existing products. Big data analytics services and new digital product portfolios are prominent in their thinking along with other digital services. Already, online e-business platforms in steel and metals distribution are becoming an industry standard, providing real-time order transparency and resultant shorter delivery lead times, higher delivery performance, differentiated service models for customers as well as higher capacity utilisation with less inventory.

Big data is transforming the steel industry with the data analytics of production and business data at the heart of improvements to production, supply chain and maintenance processes. Cloud-based supply chain collaboration enables multiple use cases across the value chain network, right the way through from upstream suppliers to the end customer, with data analytics at the heart of many product and service improvements.

The scope for digital collaboration with customers at many different levels is considerable. Strategic collaboration, for example, enables volume and market planning and collaborative product development. On a tactical level, digitisation is opening up the scope for companies to share inventory, capacity, flexibility and quality data and to plan material and capacity requirements

better. On an operational level, orders can be automatically replenished, payment and invoicing systems shared and market information and intelligence exchanged. New digital steel products include moves to use uploads from CAD systems, RFID tags for product identification and have digital systems for technical specification sheets and quality/surface information on coils.

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



Note: 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?

The scope for digital collaboration with customers at many different levels is considerable.

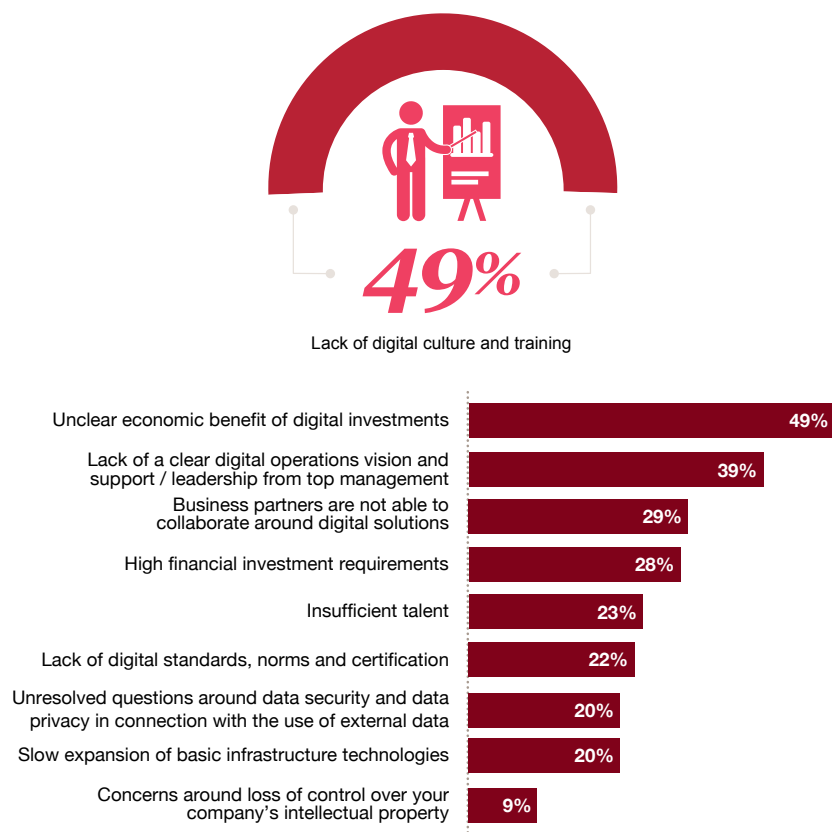
04 Focus on people and culture to drive transformation

Industry 4.0 has significant implications for the nature of how 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 metals companies, the biggest challenges revolve around issues such as culture, leadership and the economic case for change 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 two top challenges identified by metals companies are the unclear economic benefits of digital investments and the lack of a digital culture (figure 4). The third biggest challenge is the absence of a clear digital operations vision and leadership from senior management. In this respect, they are in good company as culture and leadership were lead issues across all the sectors we surveyed.

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. One of the challenges for many metals companies is the tendency for different business units to operate in isolation from each other, highlighting the importance of a clear roadmap showing how the closer integration of separate processes through digitisation can deliver more efficient and flexible production.

Figure 4: Lack of digital culture and training is the biggest challenge facing metals 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 data property management, and work to build digital trust.

Our survey data shows that many metals companies already understand the vital importance of data analytics. A half view it as important or very important to their companies today, and this rises to 83% when they are asked to look five years ahead (see figure 5).

Only 11% of metals companies have advanced data analytics capabilities

Figure 5: Metals 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?

There's still a long way to go before companies reach the level of sophistication needed to really drive Industry 4.0 applications. Only 11% of metals companies rate the maturity of their data analytics capabilities as advanced, compared to 18% across all sectors in the survey.

A key challenge is skills. Nearly three fifths (58%) of metals companies 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 (71%) 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).

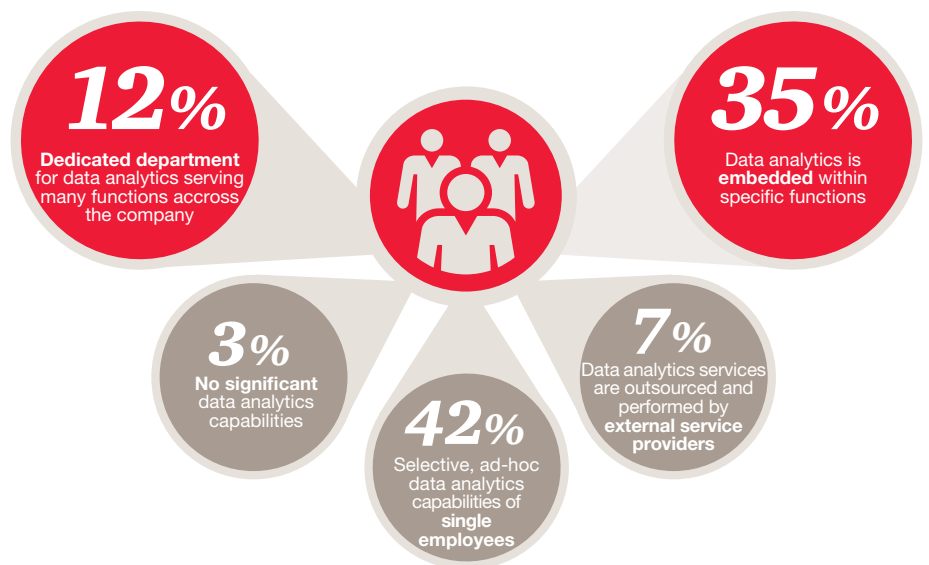
06 Robust, enterprise-wide data analytics capabilities require significant change

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 metals companies) rely on the selective, ad-hoc data analytics capabilities of individual employees, while another 3% per cent have no significant data analytics capabilities at all.

In contrast, just over a third (35%) 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 12% 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: Metals companies: 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 metals companies expect to accrue benefits from Industry 4.0 investment leads a majority (58%) to estimate a return on investment (ROI) timescale of two years or less (figure 7). Just over a third (37%) of companies anticipate a longer timescale of two to five years but relatively few (5%) think that it will take any longer than five years for Industry 4.0 investments to pay for themselves.

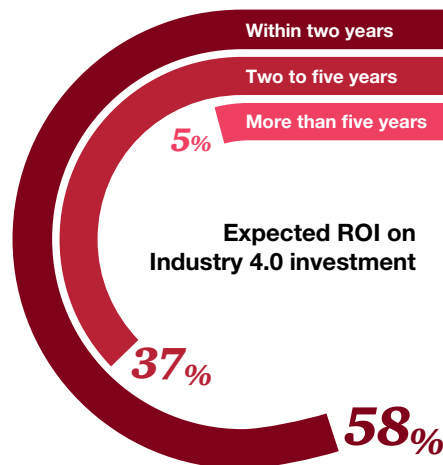
It simply won't be possible for companies to achieve advanced digitisation without making a step change in investment, given the continued rapid progress anticipated by companies who are already leading

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. This requires 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: Metals companies: 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 digital 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 and make sure these are aligned with your overall strategy. Make sure company leadership is ready and willing to champion your approach.

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 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 virtuoso in data analytics

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) Transform into 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: many of 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 an ecosystem approach

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.

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. Change of this nature will transcend your company's boundaries – and probably the national boundaries of the countries where you do business.

Blueprint for digital success



Map out your Industry 4.0 strategy

1



Create initial pilot projects

2



Define the capabilities you need

3



Become a virtuoso in data analytics

4



Transform into a digital enterprise

5



Actively plan an ecosystem approach

6

Contacts

Jock O'Callaghan

Global Metals Leader
+61 402 892 632
jock.ocallaghan@pwc.com

Nils Naujok

EMEA Metals Leader
+49 30 88705855
nils.naujok@strategyand.de.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

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.

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 for further details.