

Industry 4.0: Building the digital enterprise

Chemicals key findings



222

*chemical
company
executives
interviewed in
26 countries*

Contents

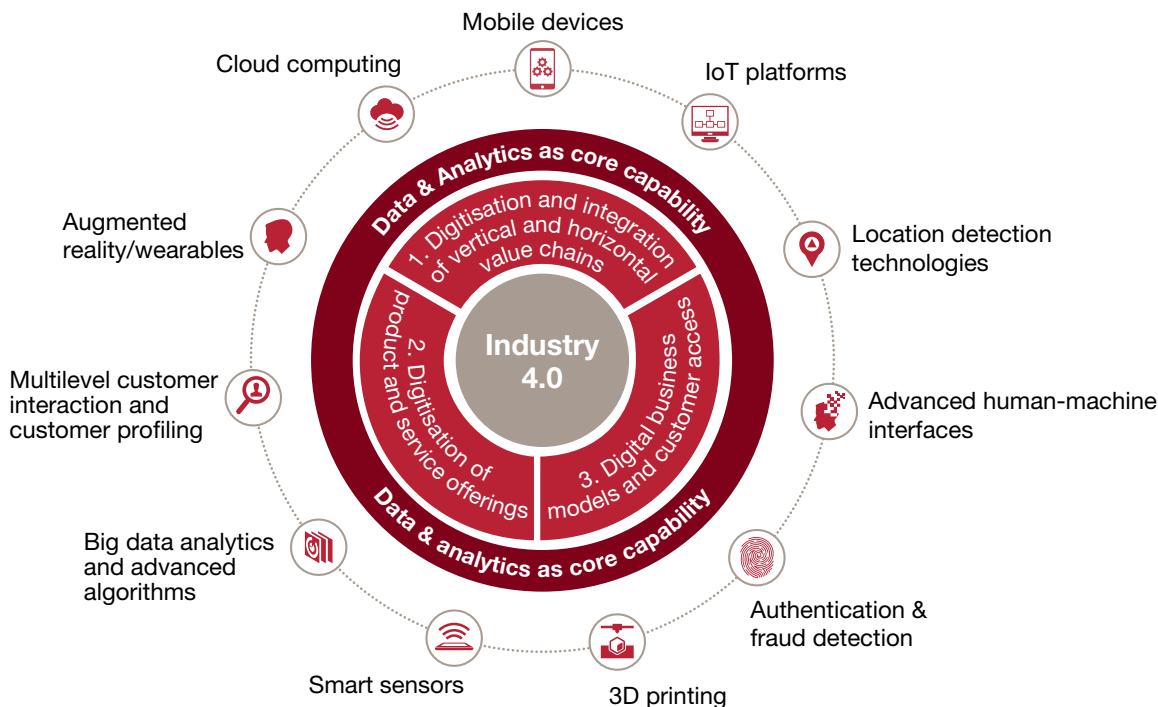
Overview	3
Key findings	4
Blueprint for success	11

PwC's 2016 Global Industry 4.0 Survey is the biggest worldwide survey of its kind, with over 2,000 participants from nine¹ major industrial sectors 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.

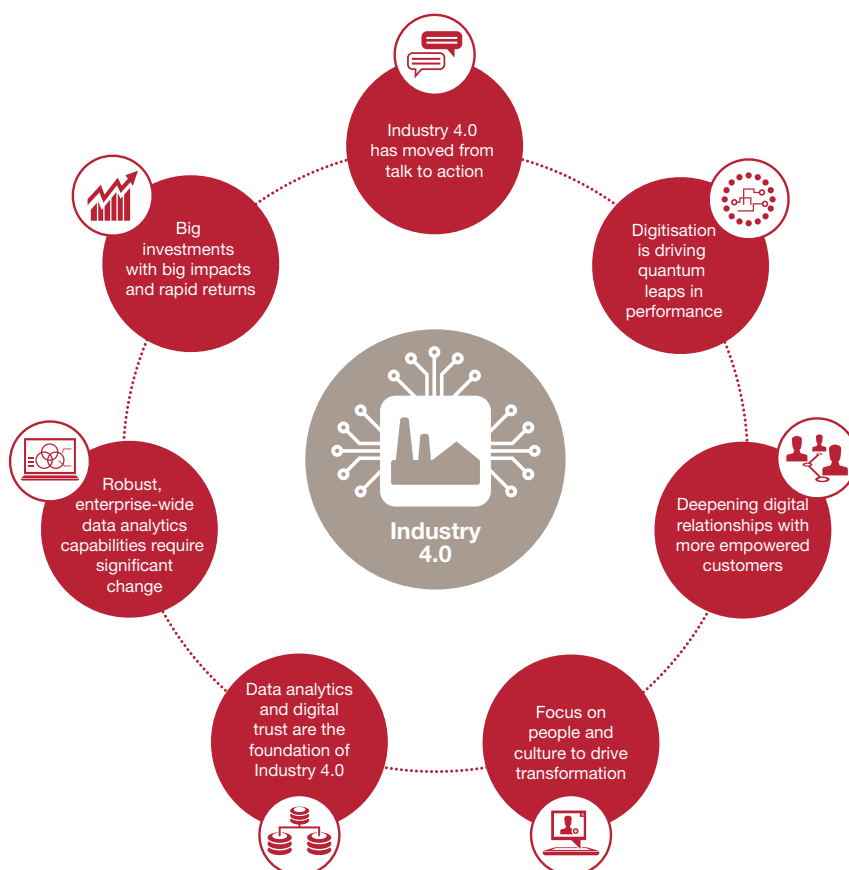
Overview

Behind the scenes of the world's leading industrial products companies, a profound digital transformation is now underway. The chemicals 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.

- Chemical companies plan to invest 5% of annual revenue in digital operations solutions in the next five years. And they are setting themselves ambitious targets for the level of digitisation and integration that can be achieved.
- The chemical industry is already well accustomed to precise process control and automation which lies at the core of the production process in many situations, although in others there is still a high reliance on significant manual processing, rooted in the expansion of the industry that dates back to the 1950s. Some companies are not even at Industry 3.0 level so have a great distance to catch up. The low oil price and the cyclical nature of the industry will make this investment difficult. Nonetheless, many chemical companies are now investing in more comprehensive digitisation within operations and are also aiming to extend this outwards across the value chain and production lifecycle.
- A number of new technologies, such as 3D printing, have direct relevance for many chemical applications, opening up potential for value chain disruption and/ or new business models, while other technologies, such as augmented reality, can enable companies to give customers real-time information and training at the point of use as well as guide maintenance. Robotics and cobotics offer opportunities to improve operational activities while other innovations offer future integration and efficiency opportunities in the supply chain.

Some of these developments are happening now. Others remain for the future. Far from being laggards in the adoption of Industry 4.0, the chemical companies we spoke to are embracing it at an increasing rate. 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. Chemical companies are making investments in line with the 5% of revenue per annum reported across all the surveyed sectors over the next five years. This investment is translating into increasingly advanced levels of horizontal and vertical digitisation and integration. Nearly a third of chemical companies report that they have already reached an advanced level of digitisation and integration and more than three quarters expect to be at such a level in five years' time (figure 1).

Indeed, the 75% of chemicals survey participants who expect to have reached advanced levels of digitisation in five years' time is one of the highest among the industry sectors covered in our survey. Companies may well feel that the process control and automation that many have put at the heart of their plants gives them an advantage. But one of the challenges will be to resolve interface and architecture challenges and to successfully build outwards and beyond the boundaries of individual plants.

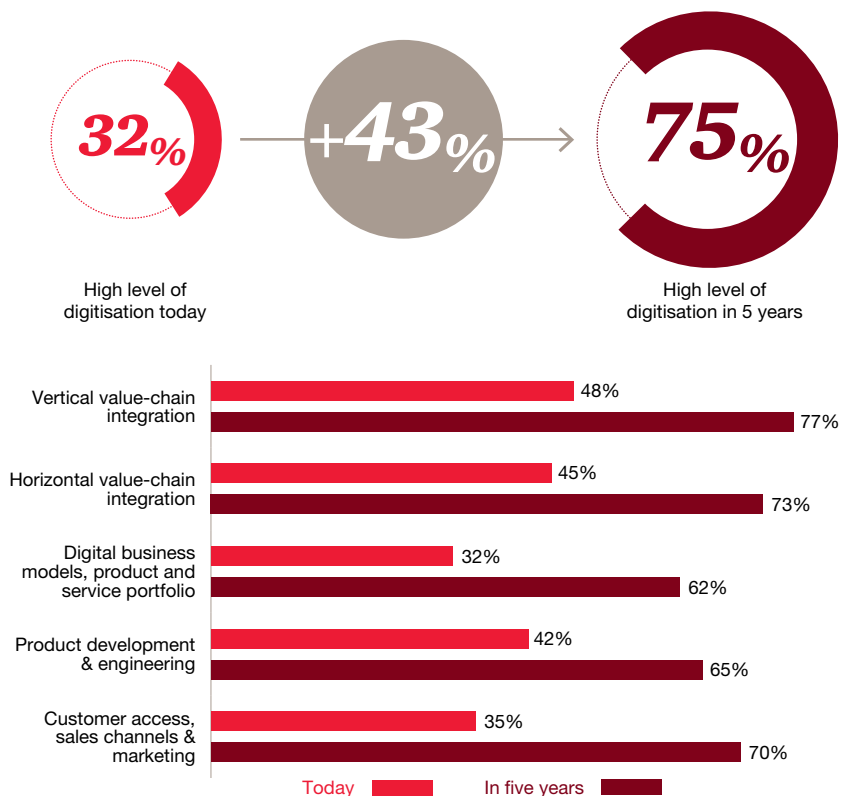
Indeed, in common with other sectors, advanced digitisation and integration of the horizontal value chain, with suppliers, customers and other value chain partners, is progressing a little slower than with the vertical value chain. Nonetheless, chemicals companies seem to be more optimistic about their rate of adoption, with the 73% expecting advanced digitisation of the horizontal value chain being the highest among all of the nine industrial products sectors we surveyed and considerably above the 65% across all of the nine sectors.

The slowest advancement of digitisation and integration, according to our survey results, is on the business models and product and service strategies of chemicals companies. Less than a third (32%) report that they are advanced now, although this rises to 62% in five years' time. Nonetheless, in common with other process

industries such as metals, this lags behind many other sectors. It compares, for example, with 64% across all the sectors surveyed, 68% for industrial manufacturing and 74% for aerospace, defence and security. Companies need to ensure they do not get left behind and fail to recognise that their industry too is being changed by digitisation. Even though chemicals companies will continue to produce and sell physical chemical products and materials, digitisation opportunities in business models, sales and marketing will significantly change the future value-creation levers and the go-to-market approach in chemicals.

48%
of chemicals respondents say they have already reached a high level of digitisation in vertical value chain integration

Figure 1: Chemical respondents expect to more than double their level of digitisation by 2020



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 sectors that we surveyed expect to reduce costs by 3.6% per annum. Chemicals companies are similarly optimistic and, indeed, have higher expectations of cost savings (figure 2).

Survey participants also expect additional significant revenue growth to flow from their new digital business models, new sales approaches and integration initiatives. Again, the expectations of chemicals companies are only slightly ahead of those of companies in all the sectors covered in the survey. They anticipate a revenue gain of 3.1% per annum compared to 2.9% in the survey as a whole.

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 chemical 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.

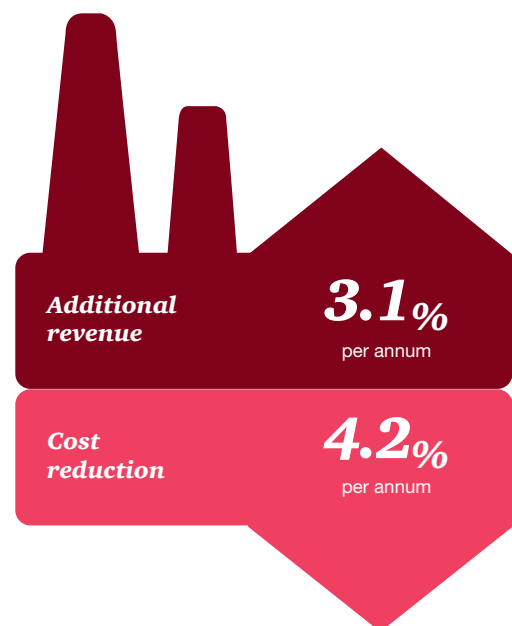
One of the big issues for chemicals companies is supply and demand planning and the need to achieve better linkages and transparency across their entire value chain – from procurement via manufacturing to distribution. Using digitisation to gain visibility and direct integration into real demand will enable improved forecasting and planning of operations. It is a real step-change challenge for many companies that currently don't have complete transparency about the inventory, location and movement of products upstream and downstream of operations or actual demand straight from customers. Many SAP APO systems still rely on forecasts from sales staff and manual inputs to a large extent.

Thus, greater transparency of the supply-demand situation, in combination with other developments such as predictive maintenance, can help to greatly reduce idle costs in production. It will also enable companies to have improved visibility over the real utilisation and efficiency of their different plants across the globe and future capacity requirements.

Those who are slow to explore digitisation and data analytics may find it difficult to compete. In an increasingly cost-competitive market, no company in the chemicals sector can afford to lose opportunities to improve their cost and revenue position against their market peers.

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

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. They 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 offerings to customers, either by digitising existing products or by developing new digital services. The opportunities resulting from digitisation can enable new revenue streams, increase customer retention, slow down the speed of commoditisation and/or enable differentiation from competitors as well as provide better demand management for customers by using predictive techniques.

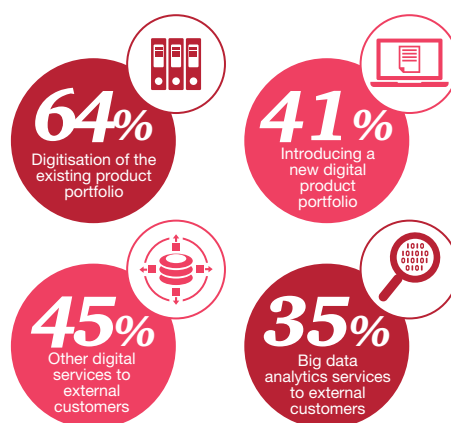
Chemicals companies plan to expand their digital portfolio, starting with the digitisation of their existing offering but also expanding into new products and data services (figure 3). Nearly two thirds say that the digitisation of their existing portfolio will be significant for their future revenue over the next five years. Rather fewer expect to introduce new digital services or to utilise big data analytics in their services to customers.

Nonetheless, there is considerable scope to gather and leverage better knowledge about the chemical and physical properties of the product in the customer's application and use that to customise products, improve collaboration and develop shared tools and services. Some companies are already exploring the opportunities that arise from a wider digital ecosystem in their product markets. Many companies are looking at outcome data in their end markets, not just to inform product development but also to add value-added services to customers.

For example, in the agrochemical sector, companies supplying crop protection products and/or seeds are participating in ecosystems that can provide easy access to data and analysis on geo-location, diagnostics, crops, fertilizers, weather and other factors, over smartphones or through direct connections with farm equipment. European companies such as Bayer and BASF, as well as

US-headquartered companies like DuPont and Dow Chemical are among the companies that have developed these kinds of precision agriculture solutions for farmers.

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



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?

Most companies we spoke to are expecting to strengthen their digital offering to customers, either by digitising their existing products, developing new digital products, or by using big data analytics to offer services to external customers.

04 Focus on people and culture to drive transformation

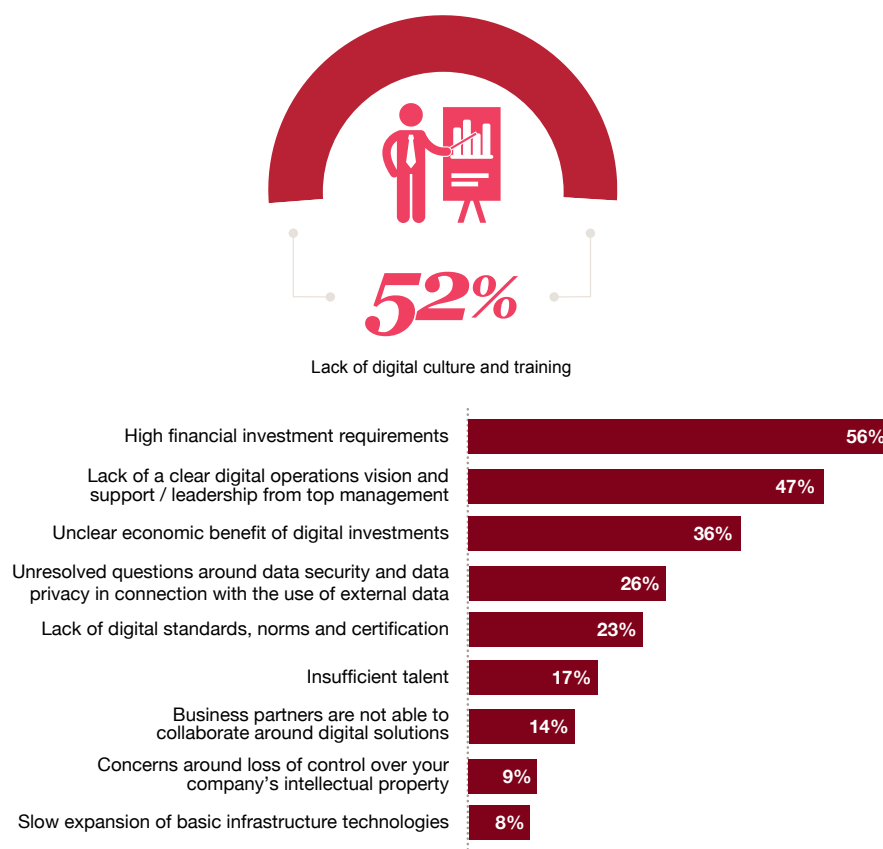
Industry 4.0 has significant implications for delivery models and the way in which a company chooses to organise itself and develop the required capabilities. Companies will need to make sure staff understand how the company is changing and how they can be a part of it. From our interviews with chemicals companies, the biggest challenges revolve around internal issues such as culture, organisation, leadership, capabilities and the speed of transformation 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 chemicals 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. But it is a particular challenge for chemicals companies given the 'legacy' nature of

many companies. Many are over 100 years old and are steeped in an 'analogue' rather than a 'digital' culture. The speed of the move to digital is something that should not be underestimated by them. Many sales forces remain volume-focused and risk neglecting the new value levers that digitisation offers. The risk is that these opportunities will be seized by other players in the digital ecosystem.

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 important issue for chemicals companies. Indeed, 47% placed it among their top three challenges compared to 40% of companies across all the sectors we surveyed. Clearly culture and leadership 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 chemical 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

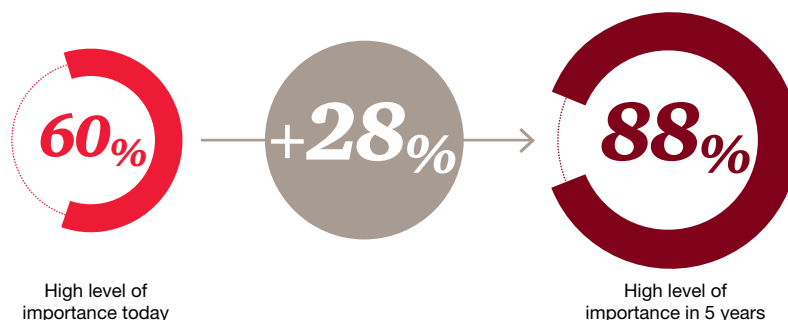
Data lies at the heart of the fourth industrial revolution, but the massively growing information flow brings little value without the right analytics techniques. The rapidly growing number of sensors, embedded systems and connected devices as well as the increasing horizontal and vertical networking 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 shows that many chemicals companies already understand the vital importance of data analytics. Three fifths 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).

There is a big leap in the number of chemical companies attaching a high importance to data analytics.

Figure 5: Chemicals 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 27% of chemical companies rate the maturity of their data analytics capabilities as advanced – although this is higher than the 19% result across the whole survey population.

A key challenge is skills, although again chemicals companies were slightly more optimistic than other sectors, with just 17% of chemicals companies ranking 'insufficient talent' as a leading challenge versus 25% of companies in the survey as a whole. Nonetheless, nearly half (46%) pinpoint the 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 three quarters (74%) 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).

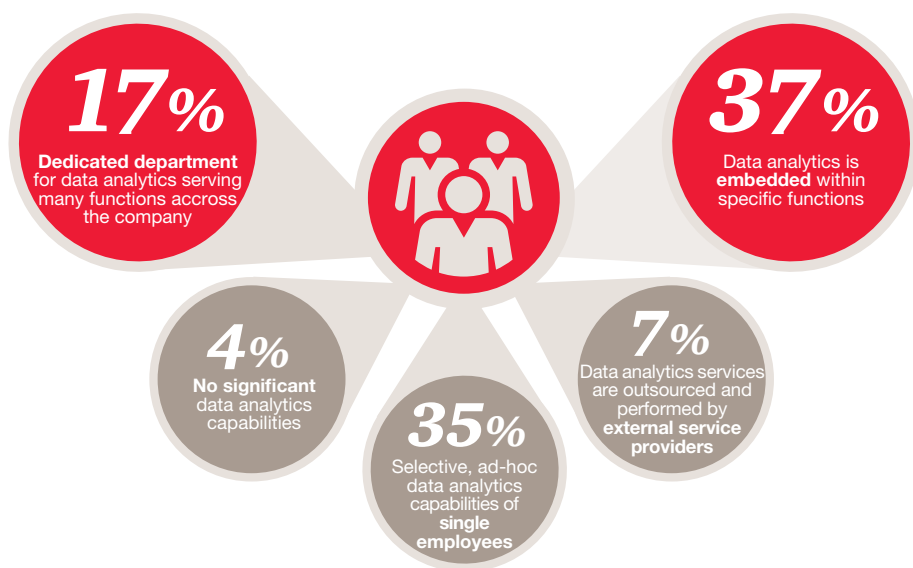
06 Robust, enterprise-wide data analytics capabilities require significant change

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 two fifths of chemicals companies lack a structured approach to data analytics organisation and governance. Many (35%) rely on the selective, ad-hoc data analytics capabilities of individual employees, while another 4% have no significant data analytics capabilities at all.

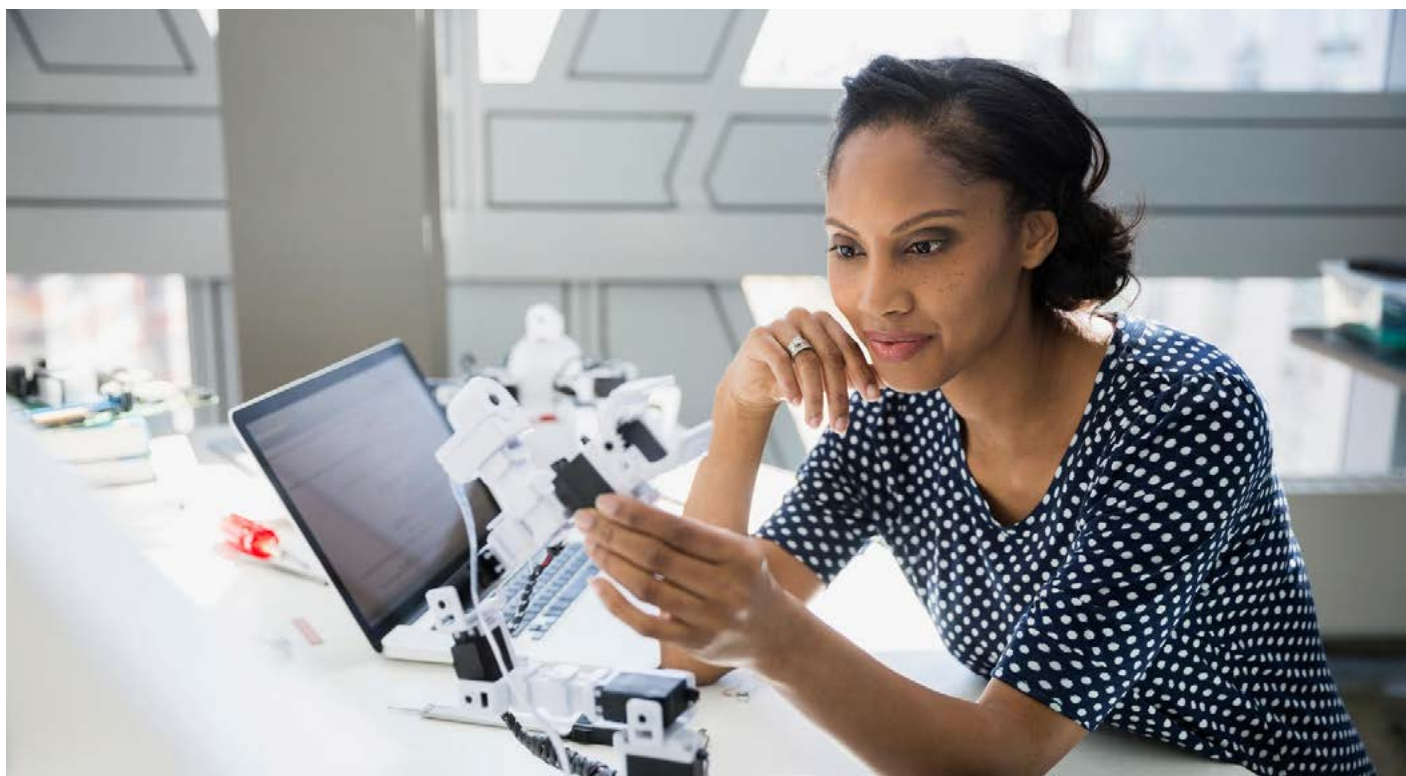
In contrast, just over a third (37%) have embedded data analytics into specific functions, giving themselves the flexibility and proximity to business knowledge to fully utilise the potential of data analytics. Another 17% of companies have a dedicated department for data analytics serving many functions across the company.

Across all sectors, our survey found that companies that 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: Chemicals: 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 users 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 chemicals companies expect to accrue benefits from Industry 4.0 investment leads nearly half (48%) to estimate a return on investment (ROI) timescale of two years or less (figure 7). A similar proportion (43%) of companies anticipate a longer timescale of two to five years but relatively few (10%) think that it will take any longer than five years for Industry 4.0 investments to pay for themselves.

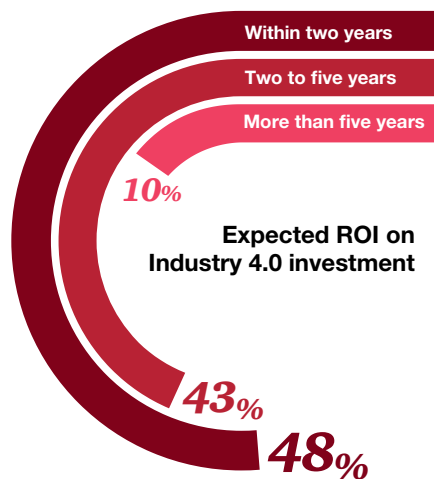
Companies who try to jump in too late will find that their internal cultures have lagged behind.

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, culture and building the required capabilities – the entire way of working and collaboration. These require long-term change programmes.

Furthermore, innovative digital business models can also lead to a significant first-mover advantage for front runners – these differentiation opportunities are expected to create a significant competitive advantage. 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: Chemicals: 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 partner – 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.

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

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