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# Is UK Industry ready for the Fourth Industrial Revolution?



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# Is UK Industry ready for the Fourth Industrial Revolution?

**Frank Cordes, Nigel Stacey**

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## AT A GLANCE

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Brexit may command the headlines but a parallel challenge of at least equal importance faces the UK over the next few years. Industry 4.0, which many are referring to as the Fourth Industrial Revolution, brings a whole host of new digital technologies that are set to have a disruptive impact on the UK's workforce and pose significant questions and challenges for our society at large.

BCG has conducted a survey of more than 1,500 senior executives and managers across five leading industrial economies to assess the extent to which those industrial nations are ready for Industry 4.0, the challenges implementing the new technologies will pose and the benefits to be grasped by all. The potential impact of the UK embracing Industry 4.0 could be as profound as providing a clear path to sustainable productivity improvement of 5-8% and thereby position the UK for long-term competitiveness, so vital in a post-Brexit economy and in doing so reverse the current productivity gap to the rest of the G7.

This report focuses on the extent to which UK manufacturers are ready for Industry 4.0, how the UK compares with its nearest neighbours, the challenges to adoption as seen through the eyes of C-suite executives as well as the benefits.

The report also explores the role of Industry, Government and Academia, and finds a need for a coordinated and collaborative relationship between all three to ensure that the UK can be among the leaders in Industry 4.0 adoption.

By leading this next digital industrial revolution, the UK could realise industrial efficiency gains of 25%, manufacturing sector growth of 1.5-3%, delivering annual growth of approximately 0.5% of GDP. These benefits could be much higher with a clear national strategy which supports the UK's industrial digital transformation plans.

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**B**REXIT AND ITS POTENTIAL consequences may command the headlines, but a parallel challenge of at least equal importance faces the UK over the next few years.

Whether you call it the Fourth Industrial Revolution, or prefer the snappier Industry 4.0 matters far less than being aware of what the application of digital technologies will mean not only for our 30 million-strong workforce and the companies they work for, but also for the economy and society as a whole. Business, government and academia will all have roles to play in meeting that challenge.

Some companies and cutting-edge researchers have known it for some time. Now awareness is reaching the political sphere. The Chancellor of the Exchequer, the Governor of the Bank of England and the Leader of the Opposition have all spoken about it in recent weeks. The first House of Commons debate took place in September and an All-Party Parliamentary Group on the Fourth Industrial Revolution has been set up, while the 2016 Autumn Statement included much-welcomed investment commitments intended to assist. All of this followed on from the 2016 World Economic Forum, which had “Mastering the Fourth Industrial Revolution” as its theme.

It also signals awareness that as the UK prepares to leave the EU, competition will only intensify and hence Brexit has made industrial competitiveness even more important. The shift to Industry 4.0 is a serious challenge for the UK, but also an opportunity. The country which led the First Industrial Revolution from the late eighteenth century now has the chance of a similar role in the Fourth, and by taking that chance can close the “productivity gap” which is such a persistent drag upon its competitiveness.

The revolution is in its early stages, but is set to accelerate over the next five to 10 years. BCG’s survey of 1,500 managers across five leading industrial economies – the UK, France, Germany, the US and China – shows common patterns across each country. In every one, most companies are aware of the challenges posed by Industry 4.0 which may change their corporate structures, cultures and practices almost beyond recognition. Few, though, have advanced very far into that process. But the survey also shows that the next few years will see that trickle of early adopters become a deluge, and one lesson of past industrial transformations is that slow starters may never catch up<sup>1</sup>.

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“The shift to Industry 4.0 is a serious challenge for the UK, but also an opportunity”

Across four key dimensions the UK companies surveyed showed that preparing for Industry 4.0 and making initial progress is underway.

#### EXHIBIT 1 | Industry 4.0 adoption in the UK



1. Proportion of answers "2-Little progress", "3-Intermediate progress" and "4-Large progress"

2. Proportion of answers "2-Partially", "3-Largely" and "4-Completely"

3. Proportion of answers "Developed first concepts", "Implemented first measures" and "Full concept in implementation"

4. Proportion of answers "Developed first concepts", "Implemented first measures" and "Full concept in implementation"

**Source:** BCG anonymous survey to managers of industrial companies

(312 in Germany, 315 in the US, 322 in France, 322 in the UK, 258 in China)

Whilst these figures are encouraging for the UK, the overall picture shows that the country lags slightly behind its competitors, China, Germany and France. For example of those surveyed, 90% in Germany and 89% in France identified themselves as making some "progress towards Industry 4.0", compared with 78% for the UK, while an astonishing 98% of Chinese respondents felt they had already made some progress.

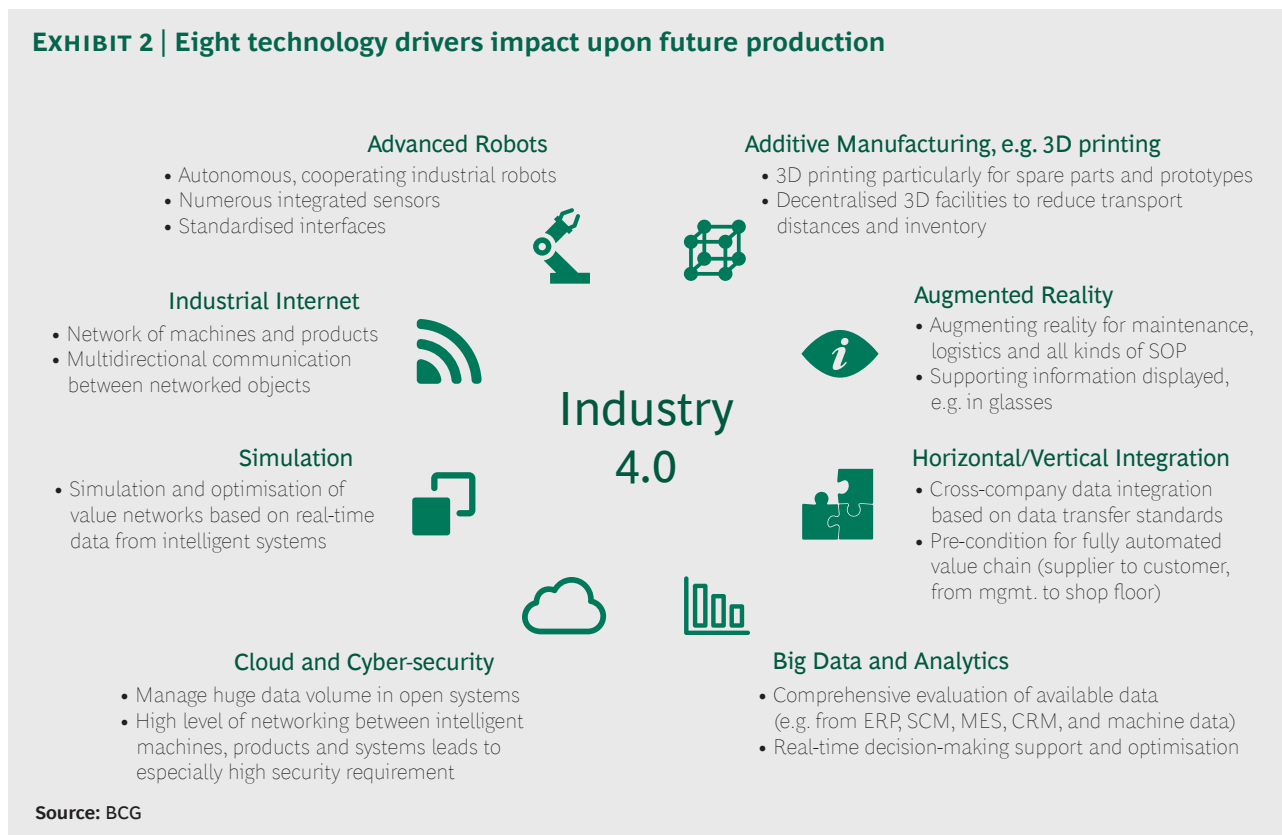
The UK was in fact around 10-12 percentage points behind its European counterparts for goals reached and preparation for skills, and technology. However the gap is by no means unassailable and the opportunity remains for the UK to be a leader in Industry 4.0 in Europe, providing it acts swiftly.

## What is Industry 4.0?

Industry has gone through three previous technological transformations, each with a profound effect on its practices and productivity. Steam power was the transformative force of the nineteenth century and electricity of much of the twentieth, before large-scale computerisation began the third significant shift in the 1970s.

The term “Industry 4.0” may have originated in Germany, but the phenomenon and its impact will be worldwide. Manufacturing practices will be transformed, as information technology, mobile communications and e-commerce have already been, by the application of digital technologies. It will transform industry as profoundly and irreversibly as each of its three predecessors, and much more quickly than any of them.

The Boston Consulting Group has identified eight drivers of this technological change, illustrated in the graphic below:



These changes will have the potential to create Factories of the Future which will move towards fully integrated and automated production flows. Systems will be able to interact with each other, to analyse data to predict failures and to create faster, more flexible and more efficient processes. Supply chains will be fully integrated along their entire length. The human workforce will increasingly operate alongside and interact with robots which will take on, in particular, physically demanding and repetitive processes.

“Successful adopters will reap the rewards in production, efficiency and competitiveness”

## What could this mean for the UK?

The UK’s current productivity gap is a significant drag on the performance of its economy when compared to other major economies<sup>2</sup>. In February 2016 the Office for National Statistics estimated that the UK output per hour was 18% below the average for the other six members of the G7. With no clear path established to sustainable productivity improvement, the UK’s ability to remain competitive in the long term is hampered.

Industry 4.0 has the potential to close this gap. BCG analysis suggests that its application over the next decade will make industrial production 30% faster and 25% more efficient. These new technologies are already having an impact on parts of UK manufacturing. Additive manufacturing is playing an ever-increasing part in creating high-end components for aerospace. Significant sectors should benefit from technological advances, with robots revolutionising the automotive sector, while integrated logistics networks can bring significant cost savings to retail, food and beverages manufacturers. Successful adopters will reap the rewards in production, efficiency and competitiveness projected by BCG<sup>3</sup>.

The potential prize for the UK is hugely significant. BCG estimates that cost reductions in labour, operations and logistics could lead to productivity gains of 5-8% of manufacturing costs by 2025.

This of course has a knock-on effect for the wider economy. Manufactured goods sales will be increased by the sector’s own demand for new equipment and new data applications, as well as greater consumer demand for the wider range of goods created by the new technologies. BCG projects potential growth of between 1.5% and 3% across the manufacturing sector, delivering annual growth of approximately 0.5% of GDP, but it could be much more with a clear national strategy which supports industrial digital transformation plans<sup>5</sup>.

At the same time technological change invariably brings with it the fear of job losses. Industry 4.0 will undoubtedly have a profound effect on the workforce, changing the types of jobs on offer, and will increasingly raise many socioeconomic debates in industry and society at large. Most projections foresee the loss of unskilled jobs, and some experts predict that redundancies will also stretch further, with automation and intelligent machinery taking over what were previously white-collar roles.

However, as the study shows, there will be substantial demand for “new jobs” Posts such as “industrial data scientists” and “robot coordinators” will become commonplace. Some existing jobs will change almost beyond recognition. Maintenance engineers, for instance, will view machinery remotely, order new parts for repairs before they arrive on site and be helped in making those repairs by augmented-reality technology and advice from experts off-site.

Ultimately, gains are likely to outweigh losses with BCG projecting a likely net addition of around 100,000 jobs to the the UK’s workforce between now and 2025<sup>6</sup>. But that does not lessen the responsibility of companies and government for identifying likely losers, assessing which are capable of retraining for new roles and mitigating the impact on those displaced.

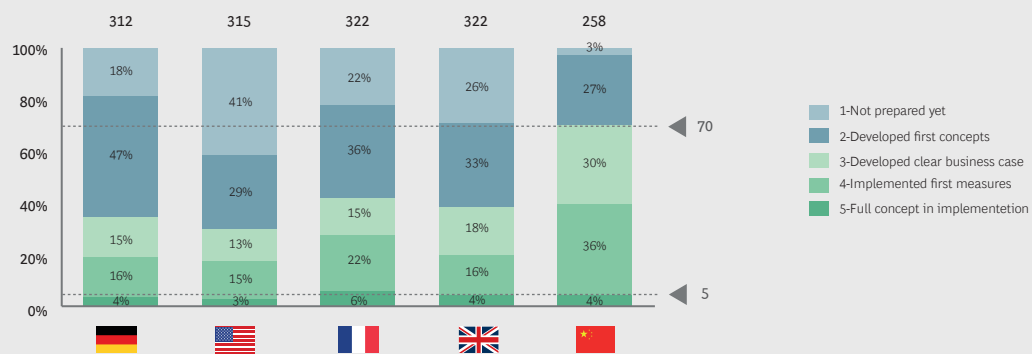


## So what does it take, and how ready is the UK?

The transformation is, as yet, much more talked about than implemented. The BCG survey found that 70% of interviewees across all five countries believe that their companies are prepared for the new technologies of Industry 4.0, but only 5% would say that they have implemented the full concept. Similarly, while 80% believe that their company has made progress towards Industry 4.0 in the last year, only 10% would describe this as “large progress”. This, though, is set to change. Among UK respondents, 40% expect to see their companies making significant progress across the whole range of Industry 4.0 technologies within the next two years, rising to 65% within five years.

### EXHIBIT 3 | 70% of UK respondents state they are prepared for the new technologies, but only 5% have full concepts in implementation

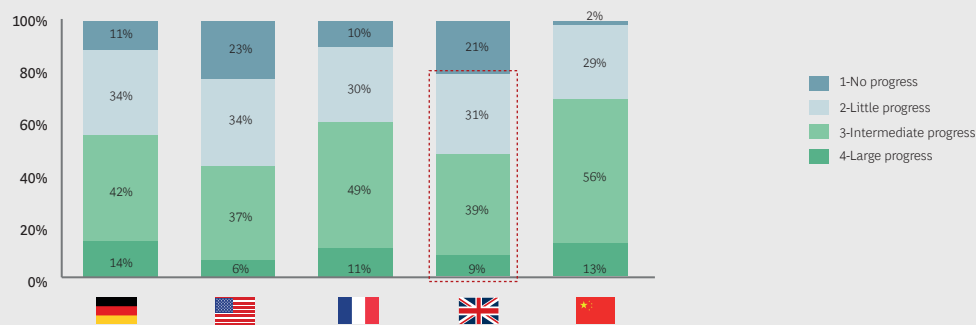
*How well is your company prepared for the introduction of new technologies for Industry 4.0?*



Source: BCG anonymous survey to managers of industrial companies (312 in Germany, 315 in the US, 322 in France, 322 in the UK, 258 in China)

### EXHIBIT 4 | 79% of UK respondents estimate that they made some progress towards Industry 4.0, but only 9% made large progress

*How would you estimate the progress of your company towards Industry 4.0 in the last year?*



Source: BCG anonymous survey to managers of industrial companies (312 in Germany, 315 in the US, 322 in France, 322 in the UK, 258 in China)

## EXHIBIT 5 | 40% of UK respondents plan to implement all Industry 4.0 topics within 2 years, increasing to 65% within 5 years

Which Industry 4.0 topics are planned or already applied in your company?



Source: BCG anonymous survey to managers of industrial companies (312 in Germany, 315 in the US, 322 in France, 322 in the UK, 258 in China)

The UK already has some significant competitive advantages in this transformation. BCG research has shown that the UK's internet economy accounts for a higher proportion of its GDP than any other member of the G20<sup>7</sup>. It is growing faster than any other sector of the the UK economy, creating employment opportunities for 1.5 million people. This advantage will be enhanced if the UK maintains its lead in introducing 5G mobile networks, currently scheduled for 2020 and continues to invest in further infrastructure, training and education required for full-scale adoption of Industry 4.0.

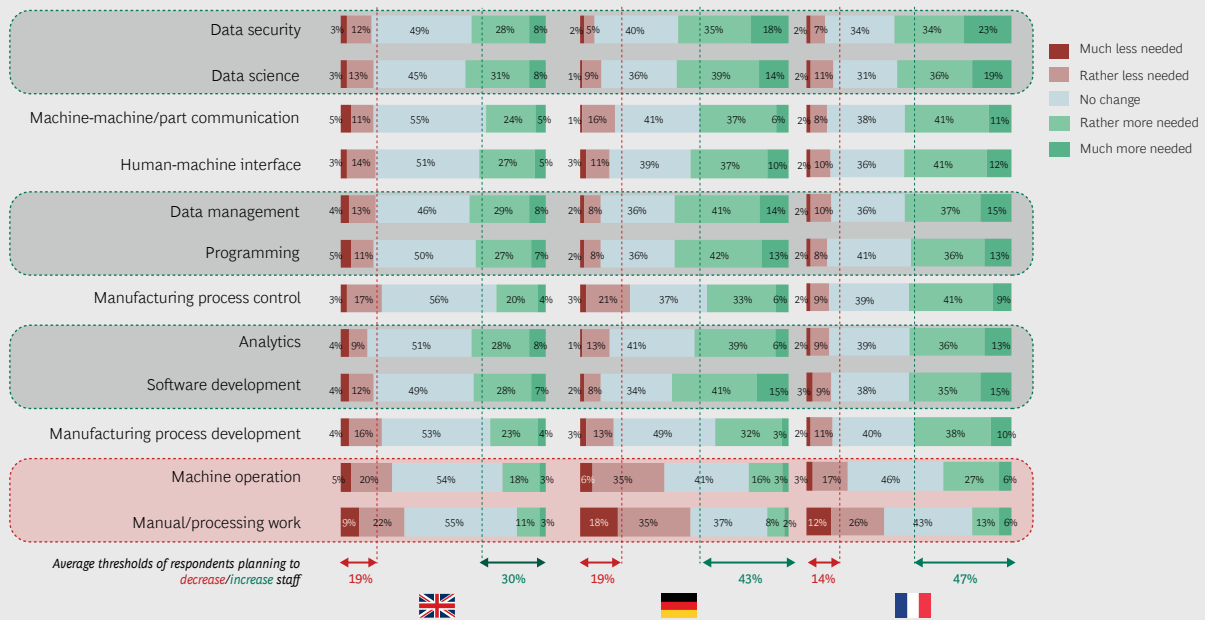
Companies will, though, face serious challenges. Effective implementation of new technologies will demand clearly-defined strategies setting out priorities and investment planning for the considerable costs involved. Workforce planning is an essential part of this. It is a matter not just of developing the skills needed, but also of understanding how these needs will be changed by shifts in culture and practice such as the changing relationship between workers and ever-more sophisticated digital equipment, and this will require new partnerships between industry, academia and research bodies.

## The changing workforce

The challenge for companies is that of adjusting their workforces to these new technologies. What does it mean for those whose jobs do become redundant, and how does it source employees with the skills which are needed now and in the future? Respondents in the UK rated a shortage of qualified staff as the most important of 13 possible challenges facing their companies, with nearly one third stating it was a "big or very big" challenge.

## EXHIBIT 6 | UK recognises the new skill requirements of I4.0 but sees less new skills required than Germany and France

*Which qualifications will you need in the future?*



**Source:** BCG anonymous survey to managers of industrial companies (312 in Germany, 315 in the US, 322 in France, 258 in the UK, 258 in China)






UK industry's preferred response to this problem showed a firm reliance on traditional methods of "on-the-job training" – 44% reckoned this their likeliest means of preparing staff for Industry 4.0, four times as many as are prepared to use educational leave of absence. In the survey, BCG identified 12 qualifications of importance for Industry 4.0. Approximately 30% of UK respondents felt that an increase in staff would be required across each skill set, however, a much greater proportion of respondents from Germany (43%) and France (47%) identified the same requirement. In addition, 62% of German respondents and 56% of those in France, saw the offering of continued internal education as strategically important to preparing their staff for Industry 4.0, compared with just 39% in the UK.

Overall there is a strong indication that both France and Germany see much higher levels of skills are needed for the Fourth Industrial Revolution. New hiring is not, despite of an aging workforce, regarded as a significant strategy for the UK, with only 15% of companies regarding this as their main means of meeting these new skill requirements.

## Technological transformation

At the same time as reorganising their workforces, companies will need to take on the challenges specific to Industry 4.0. BCG has identified 10 essential elements, under five broad headings, to the transformation.

### EXHIBIT 7 | BCG has identified 10 essential elements, under five broad headings, to the transformation.

	Data	Data infrastructure and security
	Monitoring	Electronic performance boards and mobile/real time performance management
	Operations support	Smart shop floor, production control and digital factory design, augmented reality for training and autonomous robots and assistance systems
	Task automation	Digital factory logistics supply and warehousing and predictive management
	Demand management	Social business media

Source: BCG

Survey questions about the importance of these elements showed awareness across all five countries that they matter. UK companies, in common with those from France and Germany, rated data issues most pressing, with 69% of UK respondents citing data security as “very” or “rather” important, and a 67% rating for the accompanying infrastructure. Priorities diverged elsewhere, with the main UK emphasis on mobile and real-time performance management (64%) and predictive maintenance (59%).

These priorities were reflected in the progress made by companies. Among UK respondents, 59% said that their company had made the necessary adjustments to data infrastructure, or planned to do so within the next two years, with a 56% score for data security. Exactly half pointed to similar progress on mobile real-time performance management.

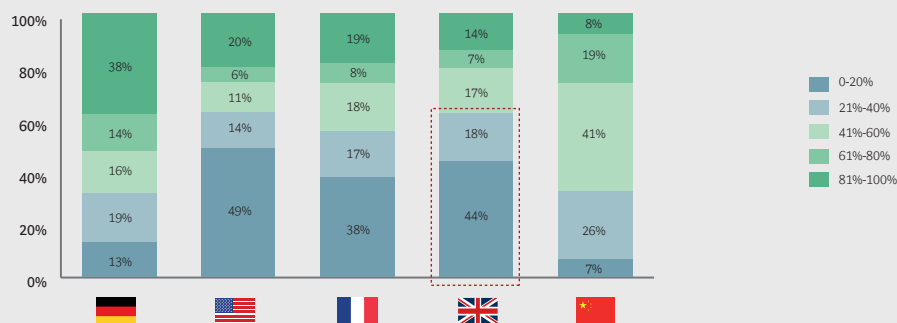
Companies do, of course, have to prioritise. But this does not mean that other challenges can be ignored. Every one of the 10 identified by BCG will have in time to be grasped. Yet, not all companies seem to act accordingly. Survey responses show that the UK has a “long tail” varying between 10% and 19% according to topic, who answered ‘not important at all’ when asked about attitudes to the various elements. Interestingly, between 19% (data infrastructure) and 37% (autonomous robots) suggested that their companies had no plans for implementation - perhaps surprising given the clear benefits that these new technologies will provide in the long term.

## Investment

The benefits of Industry 4.0 will not come without considerable costs from upgrading and re-equipping. BCG estimates that this investment is likely to amount to 7-9% percent of company revenues<sup>8</sup>.

### EXHIBIT 8 | More than 60% of UK respondents state that they cannot cover >40% of required investments for Industry 4.0 implementation

*Which share of the required investments can you cover by yourself?*



**Source:** BCG anonymous survey to managers of industrial companies (312 in Germany, 315 in the US, 322 in France, 322 in the UK, 258 in China)

Companies will need to plan transformation and associated expenditure carefully if they are not to be over-stretched, and the BCG survey shows this emerging as a serious concern for UK industry. More than 60% of UK survey respondents doubt their company's ability to cover more than 40% of the expenditure needed. Nearly one third rated finding sufficient investment a "big or very big" challenge.

But companies which focus too much on costs and too little on benefits are liable to miss out. BCG's analysis shows that companies which invest effectively should receive rapid rewards in terms of revenues, which could increase by as much as 5-8% annually<sup>9</sup>.

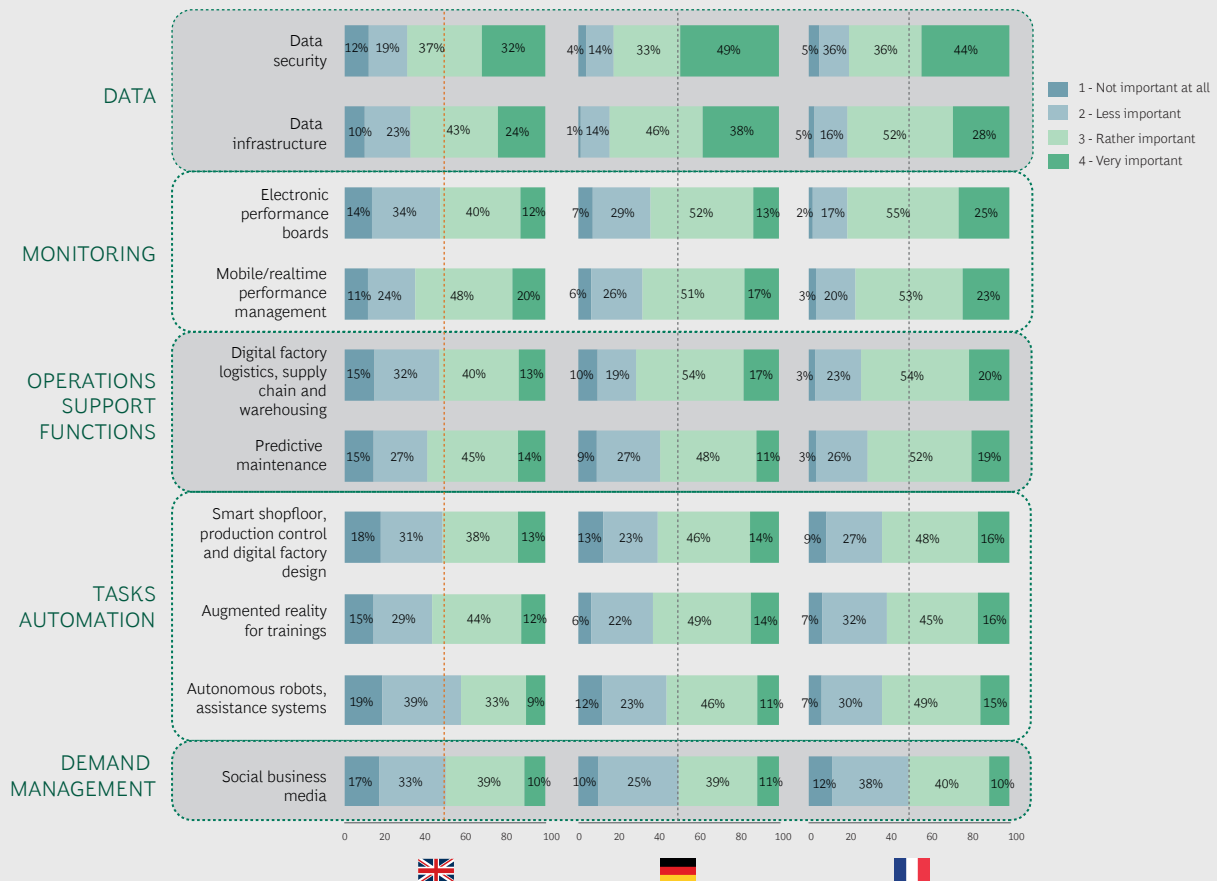


## How does the UK compare to its nearest competitors?

Pessimism in the UK about finding the investment needed for Industry 4.0 is in marked contrast to German confidence. A majority of German respondents believe that their companies will be able to find 60% or more of the costs needed, with fewer than one third believing they will be unable to cover more than 40%. This striking outcome epitomises a consistent pattern thrown up by the survey, where German and French companies outpace the UK's in terms of awareness, ambition and preparedness. The UK's competitive problem exists in part in the tail of companies that are significantly less prepared for the challenges of Industry 4.0. Among UK respondents, 21% report having no Industry 4.0 goals, more than double the size of the "tail" in France or Germany, while a further 9% report minimal progress.

Should this trend continue, it will impact UK performance across the board, its consequence evident in findings such as UK companies as a whole having more modest expectations than their German and French counterparts – only 59% believing they can increase production and cut costs compared to 78% of German and 70% of French companies. Our findings show that the more advanced companies are, the more aware they are of the challenges, of the extent of the change needed and the implications for their workforce – particularly in terms of upskilling and retraining. French and German companies expect more change in the composition of their workforces, both in terms of new jobs based on new skills and the loss of those based on more traditional roles, and are more aware of the qualifications their changing workforces will need. While no country has fully grasped the extent of the resources needed for this transformation, the German emphasis on targeted identification of qualification needs is a stronger starting point than the UK's reliance on on-the-job training.

**EXHIBIT 9 | UK rated all Industry 4.0 topics as important**  
*Which Industry 4.0 topics are particularly important for your company?*



**Source:** BCG anonymous survey to managers of industrial companies  
 (312 in Germany, 315 in the US, 322 in France, 322 in the UK, 258 in China)

As exhibits 9 and 10 show, German and French managers are likelier both to rate specific topics as important to the Industry 4.0 transformation, with particular differences for data, monitoring and operations support functions – and to be aware of the challenges they entail.

**EXHIBIT 10 | UK sees significant challenges of implementing Industry 4.0 across a range of factors**  
*Which are the biggest challenges for progress towards Industry 4.0 for your company?*



**Source:** BCG anonymous survey to managers of industrial companies  
 (312 in Germany, 315 in the US, 322 in France, 322 in the UK, 258 in China)

It doubtless also helps that both countries have taken important steps to create an environment in which progress towards 4.0 can be nurtured – Germany, through the creation of a national coordinating body, the government-led Plattform Industrie 4.0 and of national standards development via the Fraunhofer Institute, while France’s Industrie du Futur project offers a model for raising awareness of the potential of the new technologies.

## So what does the UK need to do?

The gap between the UK and its peers has to be recognised, but is not yet a gulf. And it can be closed, bringing with it all the benefits that a successful shift to Industry 4.0 can bring, by prompt and decisive action.

More than anything, the UK needs a broad and more coherent strategy. Germany, with its Platform Industrie 4.0., has a national lead body. While there were many promising announcements made by Whitehall toward the end of 2016, the policymakers must now look to build upon this platform<sup>10</sup>. Government must continue to work with industry to bring stakeholders from business and academia together in a national coordinating body capable of setting this strategy, developing awareness and understanding and drawing-up recommendations for action.

This body needs also to be backed by effectively-targeted investment. Regional investment funds could be created to encourage talent outside London and the Southeast and ensure that benefits are shared nationally. Government must also continue to invest financial capital in effective, high-speed technological infrastructure and the intellectual variety in the development of effective data and cloud security based on robust common standards.

Research bodies and manufacturers must be encouraged to develop technologies via the creation of more centres of excellence along the lines of the High Value Manufacturing Catapult. The announcement of extra help for SMEs in the Autumn Statement was welcome – far too many struggle to find the capital needed to “scale up” and become larger operations and end up selling to overseas owners. But our survey shows needs elsewhere as well – managers in large companies believe they are less prepared than their smaller counterparts for the coming transformation, while the “long tail” in all of its sizes and dimensions must be brought up to speed, or risk extinction.

That an IT skills gap is developing even before the Industry 4.0 transformation represents a challenge to both companies and the education system. Both sides must work to ensure that the future workforce has the technical skills and flexibility of outlook essential in the Industry 4.0 workforce.

Some of this work is already being done by broader social trends. The next generation to enter the workforce will already have lived digital lives, the use of smartphones and social media an integral part of their routine. But this is not enough by itself. The UK can go a long way to closing the skills gap if it can eradicate the gender gap and encourage more young women into STEM and technological disciplines.

Curriculum reform is essential at all levels of education to make IT competence integral across the range of subjects. This will help further and higher education to turn out not only larger numbers of specialists in IT, but potential recruits across the whole range of disciplines with a grasp of what Industry 4.0 entails.

Companies will be taken into unknown territory by Industry 4.0, but must embrace the changes in ways of thinking and working it will represent. Systematic workforce planning, identifying likely gaps, where there is potential for upskilling – and just as importantly where there is not, to ensure that negative impacts on the workforce are recognised early, planned for and mitigated – will be essential.

To assist industry, BCG has developed extensive Industry 4.0 readiness assessments and health checks to help companies understand the implications of Industry 4.0 and the challenges and opportunities for their organisations. BCG has assembled Industry 4.0 model factories in Paris and Germany for those wishing to take a closer look at Industry 4.0 technologies in practice, that offer the opportunity to explore how these new technologies can be applied and to assess an organisation's next steps. For more information please contact one of the authors.

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“How the UK responds now to the challenge of Industry 4.0 will determine its fortunes for a long time to come”

Also vital will be effective partnerships with the local and national educators that can provide the upskilling, informed by a vision which goes beyond the narrow training-on-the-job preoccupations shown in the survey to the commitment needed to create a workforce equipped for a world in which change becomes the norm rather than an exception.

And all of this needs to happen fast. Industry 4.0 offers the UK serious, transformational opportunities at precisely the time when, contemplating a very different economic future post-Brexit, it needs them. But action cannot wait until after Brexit. The window of opportunity is far from closed, but is getting no larger, and will be gone within the next five to 10 years. The prize is huge – no less than the closing, and possible reversal of the UK's debilitating productivity gap. But so too is the cost of failure. Either way, how the UK responds now to the challenge of Industry 4.0 will determine its fortunes for a long time to come.



NOTES:

1. More than 1,500 industrial executives and managers were surveyed between March and July 2016 in five industrialised countries: France, Germany, the US, the UK and China. The annual revenue for all companies surveyed was at least \$50m. The sample contained responses across discrete and process manufacturing, as well as other sectors including construction and services. The survey's goals were to evaluate industry managers' perceptions of their companies' progress towards Industry 4.0, identify their major challenges and their current focus, and consider the employee skills and investments required for implementing Industry 4.0 technologies.
2. International Comparisons of Productivity - Final Estimates: 2014. Labour productivity across the G7 nations in terms of GDP per hour worked and per worker, and growth in GDP per hour worked.
3. Industry 4.0 : The Future of Productivity and Growth in Manufacturing Industries – BCG, April 2015
- 4,5. UK productivity gains, revenue growth and employment growth rates by manufacturing sector estimated based on expert interviews for Germany (see “Time to Accelerate in the race towards Industry 4.0 – BCG, May 2016” and “Industry 4.0 : The Future of Productivity and Growth in Manufacturing Industries – BCG, April 2015”).
6. Internet Economy in the G-20 – BCG, March 2012
- 7,8. Time to Accelerate in the Race Towards Industry 4.0 – BCG, May 2016
9. The Chancellor announced in August 2016 that he would guarantee funding beyond the date the UK leaves the EU for projects agreed before the 2016 Autumn Statement. Available online here: <https://www.gov.uk/government/news/chancellor-philip-hammond-guarantees-eu-funding-beyond-date-uk-leaves-the-eu>  
  
The 2016 Autumn Statement outlined £400m of venture capital funds to support the UK's fastest-growing companies, and more than £1bn was secured to boost UK broadband. Available online here: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/571559/autumn\\_statement\\_2016\\_web.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/571559/autumn_statement_2016_web.pdf)

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## Further Reading

Sprinting to Value in Industry 4.0, December 2016

Using Advanced Analytics to Improve Operational Decisions, December 2016

Productivity Now: A Call to Action for US Manufacturers, December 2016

Time to Accelerate in the Race Toward Industry 4.0, May 2016

The Robotics Revolution: The Next Great Leap in Manufacturing, September 2015

Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries, April 2015.

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