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INDUSTRY4.0

Go Fourth

Insights Into The Next

Industrial Revolution

Cebr

Welcome to Go Fourth,

Irwin Mitchell's new report analysing the growing use of digital technology within the manufacturing process – something which is often referred to as Industry 4.0.

As a leading law firm which works closely with UK manufacturing businesses and has done for many years, the team here at Irwin Mitchell were interested to get a closer understanding and examine the current views and issues relating to this crucial and fast-moving area of technological advancement.

Although our starting point with this report has been the numerous Industry 4.0 studies that have been produced over the last few years by other reputable organisations, we were keen to build on this existing knowledge and we therefore teamed up with leading think tank, the Centre for Economic and Business Research (Cebr).

As part of the ***Go Fourth*** study and our aim to provide new insight into this area, we also commissioned YouGov to question 300 senior decision-makers within UK manufacturing businesses.

We wanted to gauge their understanding and perception of Industry 4.0 technologies to identify their likely appetite for investment and to understand their assessment on the expected increase in productivity. The study also examines the perceived barriers and potential legal issues that organisations are concerned about when it comes to implementing and taking advantage of this new technology.

As part of our analysis, the report also predicts what the impact in the future will be - including an analysis of employment trends in the manufacturing sector as a result of Industry 4.0. This is of course a hot topic in relation to the move towards so-called smart factories and we explore this through both the YouGov study and some in-depth modelling by Cebr.

We are sure that you will find this report interesting and valuable. If you have any questions in relation to its content and the issues raised, please don't hesitate to get in touch.

Dorrien Peters
Partner and Head of Manufacturing at Irwin Mitchell

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Executive summary

Industry 4.0 refers to the fourth industrial revolution, focused on the newest wave of technology and incorporates trends towards automation, big data, AI and the Internet of Things.

The use of Industry 4.0 technologies is significant and growing. The World Robotics Association (2016)[1] has found that 23,000 industrial robots were supplied to Western European countries[2] in 2010, growing to 35,000 in 2015. The figure is expected to rise in the future to over 46,000 in 2019. Although the use of Industry 4.0 technologies has grown in importance, the UK makes up only a small proportion of this figure, buying 1,645 robotic units in 2015. In contrast, over 20,000 were sold in Germany in 2015.

Looking at the global usage of big data analytics (using large amounts of data to find hidden patterns and other insights), PricewaterhouseCoopers[3] found that 56 % of surveyed firms are already using analytics for business planning optimisation. However, it is not being utilised in areas such as decision making with other companies or optimisation of transport or logistics costs.

Globally, industrial investment in new technology is high, with the electronics and engineering sectors leading the way. PwC (2016), found that total worldwide industrial investment in Industry 4.0 technology was expected to be $907 billion per year until 2020.

The high level of worldwide technology usage and investment is, in general, not reaching UK markets. Most reports find that decision makers in UK manufacturing firms have little knowledge of Industry 4.0 technologies and have limited plans for investment. While UK firms are aware of technologies such as cloud solutions and network control systems, other technologies including 3D simulation of the manufacturing process or augmented reality have limited planned or existing investment.

It has been suggested by The Germany Trade and Invest report[4] that the dominant service sector in the UK is a reason for the limited uptake of Industry 4.0 technology. Germany has a much larger manufacturing sector[5], and Industry 4.0 strengthens sectors such as machine engineering and the electronics industry.

The use of Industry 4.0 technologies is significant and growing

The UK government has had a lukewarm response to the new wave of technology available. The government-funded so called Catapult centres, aimed at doubling the UK manufacturing contribution to GDP, have received £200 million since 2011. However, these are not specifically aimed at Industry 4.0, and the Conservative government since 2015 has had an underwhelming attitude towards the importance of manufacturing. The majority of UK manufacturers still do not use cloud computing services; however, there was a small increase from 19 % to 32 % of manufacturing firms between 2013 and 2015.

This report for Irwin Mitchell examines the impacts Industry 4.0 has had so far on businesses and jobs. In addition to this, a survey of decision makers in the manufacturing industry provides an insight into the awareness and projected impact of advanced technologies going forward.

1 International Federation of Robotics (2016). Executive Summary: World Robotics.
2 Germany, Italy, France, Spain, United Kingdom.
3 PwC (2016) Industry 4.0: Building the digital enterprise.

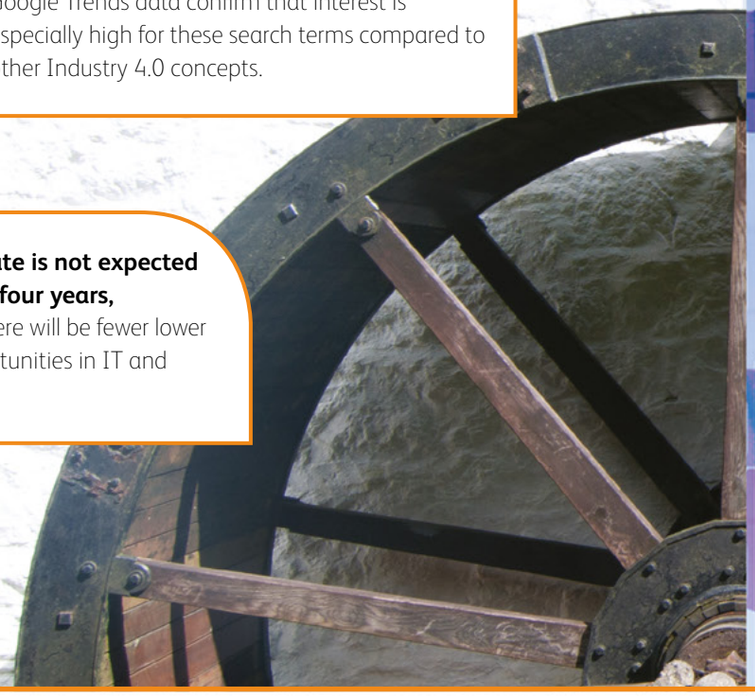
4 Germany Trade and Invest (2014). Industrie 4.0: Smart manufacturing for the future.
5 Manufacturing value added constituted 22.6 % of GDP in Germany in 2016, compared to 9.7 % in the United Kingdom (Source: World Bank).

Key findings

Investment in Industry 4.0 technologies remains limited.
Only **14%** of manufacturers have invested in big data and/or cloud solutions while **12%** invested in 3D printing technologies.

The survey results find that 3D printing and big data are among the terms with which manufacturers are most familiar.
Google Trends data confirm that interest is especially high for these search terms compared to other Industry 4.0 concepts.

Employment on aggregate is not expected to change over the next four years,
but it is anticipated that there will be fewer lower skilled jobs and more opportunities in IT and managerial roles.



The majority of manufacturers are not familiar with the application of Industry 4.0.
Only **one in three** manufacturing companies classified themselves as being familiar with the application of Industry 4.0 in the manufacturing industry. The figure is even lower when analysing small businesses only.

There are multiple reasons why companies are not investing in Industry 4.0 technologies.
Around **one in three** firms believe that their business is too small to capitalise upon the benefits of Industry 4.0 with **more than a quarter** of firms indicating that their facilities are not suitable to invest in such technologies.

Industry 4.0 is believed to result in productivity gains.
Over one third of companies believe that Industry 4.0 technologies will have a positive impact on overall productivity. **Only 2%** of manufacturers expect a negative impact on productivity.

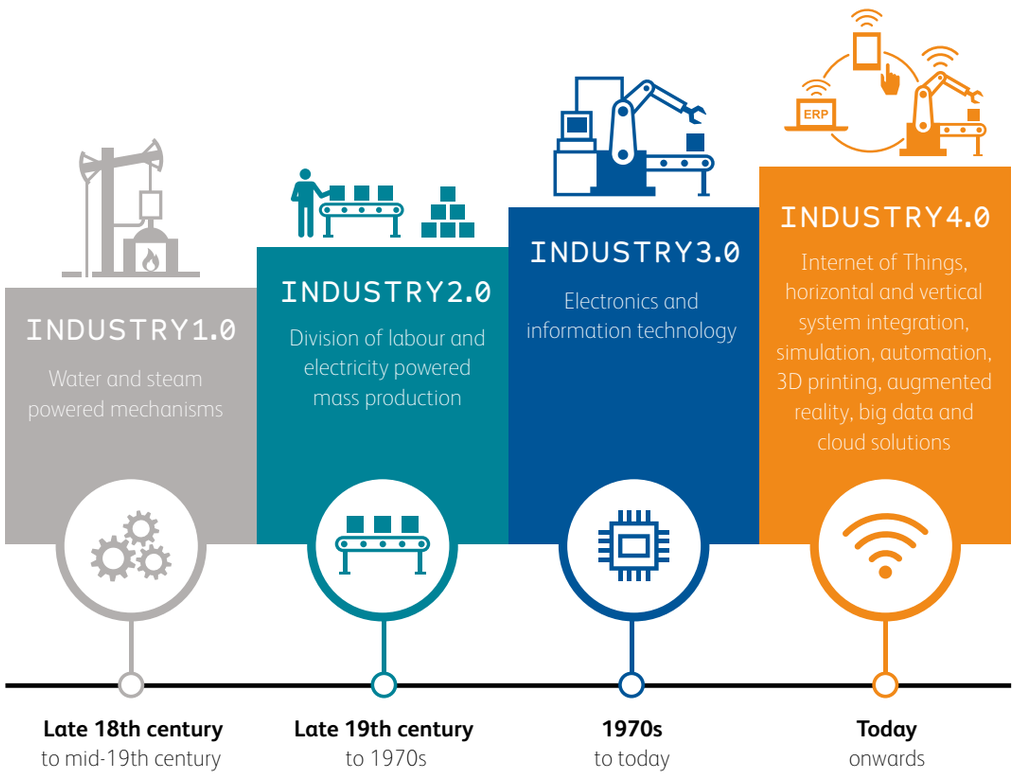
Industry 4.0 — An introduction

Industry 4.0 refers to the fourth wave of industrial revolution.

The technology developments under the Industry 4.0 umbrella include (but are not limited to) the Internet of Things, horizontal and vertical system integration, simulation, automation, 3D printing, augmented reality, big data and cloud solutions. Incorporation and development of these technological concepts may offer many benefits to manufacturers including higher productivity, increased speed of production and improved product quality. However, businesses may be put off by the costs involved in investing in these technologies, or fear cyber security threats once they are in place. Industry 4.0 is also likely to affect employment, as more tasks become fully automatable.

We have seen how previous waves of industrial revolution have shaped the economy and Industry 4.0 may potentially disrupt the current economic landscape.

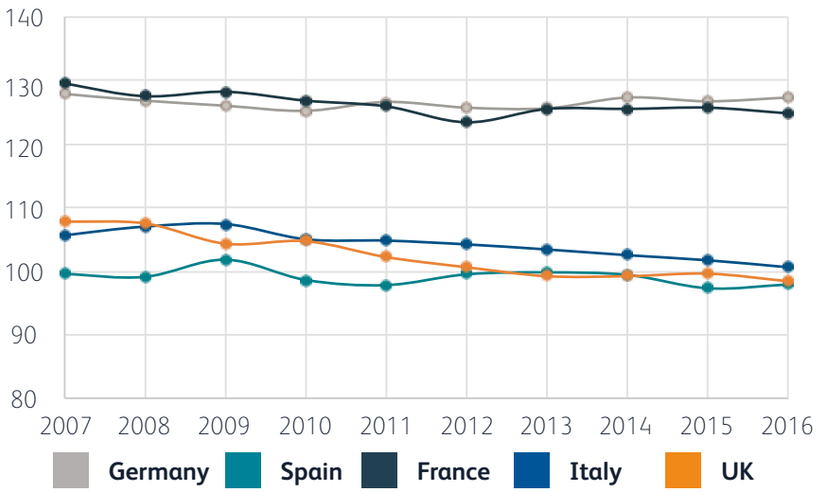
The four industrial revolutions



Benefits of Industry 4.0

While benefits of Industry 4.0 include an increase in product quality, changes in business models and an increase in speed of production, this report finds that productivity improvements are the key benefit, due to the fact that Industry 4.0 will cause significant productivity increases.

***Figure 1** – Index of nominal labour productivity per hour worked relative to EU average for that year*



Source: Eurostat

It can be seen from Figure 1 that the United Kingdom has a low level of productivity when compared to other European countries; the chart shows an index of productivity where 100 is the EU average. There is also a clear decline in UK productivity compared to the other EU countries.

The largest increase in productivity for small and medium-sized UK business from big data analytics is possible in manufacturing, where big data analytics could increase productivity by 4.7 %[6]. Insurance, retail, energy and utilities also have scope for significant improvements through the use of big data analytics. Cebr[7] also analysed the effects of cloud computing on productivity in the UK and other Western European countries and observed that the UK has low productivity in small and medium-sized firms in comparison to France and Germany. It further found that cloud computing has a small positive impact on productivity in all Western European nations.

6 Cebr (2012). Data equity: Unlocking the value of big data.
7 Cebr (2011). Economic impact of cloud computing.

***Table 1** – Small and medium-sized firm productivity pre and post cloud computing adoption*

Country	Productivity index pre-cloud computing	Productivity index post-cloud computing
France	205.0	205.4
Germany	340.6	341.3
Italy	102.7	102.8
Spain	108.5	108.8
United Kingdom	130.7	131.2

Source: Cebr

With regards to automation, Cebr[8] finds that a one-unit increase in robotics density (the number of robots per million hours worked) is associated with a 0.04 % increase in labour productivity. McKinsey[9] also predicts that up to 50 % of the total productivity growth required to achieve projected GDP per capita over the next 50 years will be caused by using robotics. The Boston Consulting Group (BCG)[10] has predicted that the use of robotics in small and medium-sized firms will cause a 30 % increase in productivity over the next decade. In general, survey results for this report by Cebr find that 34 % of firms expect output to increase as a result of Industry 4.0.

Industry 4.0 technologies are being utilised to a greater extent in Germany than in the UK. This is likely to only increase the productivity difference between the two nations further, due to the productivity improvements that Industry 4.0 technology offer. BCG (2015) calculates that Germany can expect productivity gains of 5 % to 8 % as a result of the new technology, while figures for the UK can be expected to be lower.

8 Cebr (2017). The impact of robotics on employment.
9 McKinsey Global Institute (2017). A Future That Works: Automation, Employment and Productivity.
10 Boston Consulting Group (2015). The Robotics Revolution.

Challenges created by Industry 4.0

The Bank of England[11] published data on the probability of automation for jobs in different sectors of the UK economy. Overall, they found that 35 % of jobs are at a high risk of automation, with administrative and secretarial jobs being most at risk (for which we also forecast a fall in employment). There is a general trend towards lower median pay jobs having a higher probability of automation. However the substitution effect resulting from machines replacing humans may be cancelled out by the compensation effect, due to the increase in demand for goods and services caused by an increase in real incomes. Indeed, the Bank of England found evidence that over time, labour saving technologies have resulted in an increase in aggregate employment, although working hours have fallen.

A Barclays[12] study in the UK found that an investment of £1.24 billion in automation over the next decade could safeguard 73,500 manufacturing jobs and create over 30,000 jobs in other sectors. The skill requirements will, however, be different, with a swing towards high-skilled labour employment, especially in software development and IT. Therefore, there needs to be an emphasis on retraining individuals for the change in skills demanded by employers. Deloitte (2015)[13] surveyed Swiss firms and also found evidence that Industry 4.0 developments require significant retraining in IT, with only 4 % of those interviewed stating that they had all the skilled workers needed to use Industry 4.0 technology.

One of the most significant deterrents for firms using new technologies is the fear of cyber-attacks. According to Deloitte (2015), 48 % of those surveyed reported that Industry 4.0 would considerably increase cyber risks for manufacturing companies, while 73 % of respondents to a BDO (2016) survey said that the increased use of Industry 4.0 will raise the risk of cyber security breaches. However, 48 % believed that they have the right IT systems to counter this threat.

One of the most significant deterrents for firms using new technologies is the fear of cyber-attacks

Many firms believe that they cannot take advantage of Industry 4.0 technologies because they are too small to do so, or because their staff do not have the right training to use it. 50 % of businesses in a PwC report[14] said that a lack of digital culture and training meant that they were not investing in Industry 4.0 technology. This emphasises that the high costs of investing in new technologies are exacerbated by significant staff retraining costs.

Other key concerns are data protection and regulatory issues. Data and intellectual property protection may be harder to keep control of once big data analytics are used more widely. PwC found that 14 % of firms were concerned about loss of control over their intellectual property. Further challenges to businesses using Industry 4.0, which relate to our own unique research, are shown in Figures 6 and 7 (pages 32 and 33).

11 Labour's Share (2015). Speech given by Andrew G Haldane: Chief Economist, Bank of England.
12 Barclays (2015). Future-proofing United Kingdom manufacturing.
13 Deloitte (2015). Industry 4.0 Challenges and solutions for the digital transformation and use of exponential technologies.

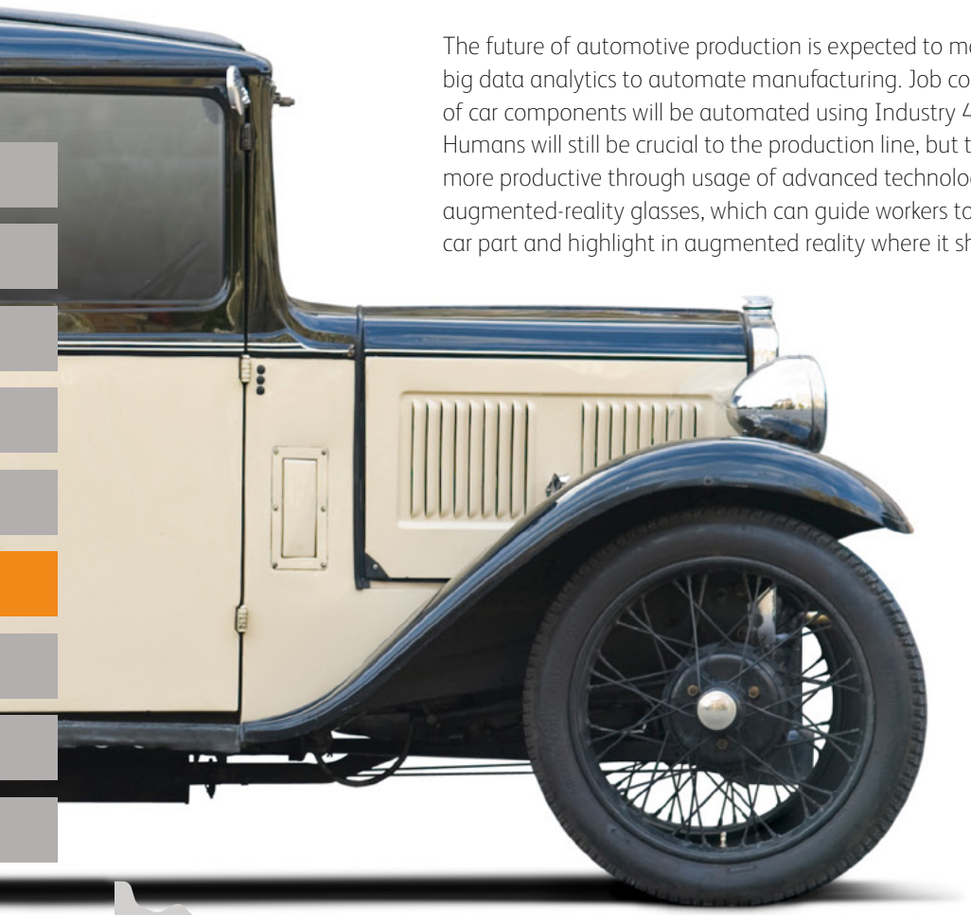
14 PwC (2016) Industry 4.0: Building the digital enterprise.

Automotive

The global automotive sector has the highest rate of Industry 4.0 usage according to a BDO (2016) report. Their estimated worldwide annual supply of industrial robots was the highest of all sectors in 2015, at nearly 100,000 units[15]. This sector was one of the first to use new technologies to vary products within the production line[16] and manufacture cars in series with high variability and large differences. Today, the ability to offer customisation for less expensive products from a production line is possible through the adoption of Industry 4.0 technologies.

Despite the automotive sector being the most advanced in using Industry 4.0 technologies, BCG (2015) calculate that this sector can still expect increases in productivity of 10 % to 20 % in the future. In comparison, at 20 % to 30 %, manufacturers of automotive components have the potential for the largest productivity gains according to the report.

The future of automotive production is expected to move towards using big data analytics to automate manufacturing. Job control and ordering of car components will be automated using Industry 4.0 technologies. Humans will still be crucial to the production line, but they can be made more productive through usage of advanced technologies such as augmented-reality glasses, which can guide workers to select the correct car part and highlight in augmented reality where it should be located.



15 International Federation of Robotics (2016). Executive Summary: World Robotics.
16 BDO (2016) Industry 4.0 Report.

Sarah Riding
Partner and Automotive expert at Irwin Mitchell

"The automotive industry has readily begun to embrace Industry 4.0. Consumers are also demanding connectivity and technological advancement within vehicles which is forcing the sector to evolve. Digitalisation can help save time, reduce costs and improve processes, and automotive manufacturers and suppliers are already reporting greater profitability.

"The industry will have to continue pushing towards visibility across its supply chain. Every link of the automotive supply chain will need to be connected, and central to smart manufacturing will be a focus on transparency and co-operation.

"Continuous demand sensing will require a supply chain that is able to respond in real time. We also anticipate a change in contracting methods, with much greater flexibility and an increased focus on 'just in time' processes."

Food
manufacturing

Industry 4.0 can help with improving food quality and shelf life, through supporting traceability of goods. Technologies can enable food manufacturers and actors in the supply chain to use electronic systems to track which products are out of date.

In fact, one of the key benefits of Industry 4.0 for all industries is improved supply chain integration. This means that food manufacturers can connect with other businesses in their supply chain more efficiently through sharing data and electronic systems. Looking forward, smart factories are being specifically designed for use in food manufacturing[17]. These factories include automated production, online machine and operational data capture, mobile business applications and cloud solutions.

Smart factories are being specifically designed for use in food manufacturing

The head of process and automation at AECOM notes that the food industry is not taking full advantage of new technologies. They cite that one of the main challenges to the food industry is having a skilled workforce capable of understanding and maintaining large datasets and automated machinery.

The International Federation of Robotics[18] have found that the food industry had the lowest annual supply of industrial robots between 2013 and 2015 out of the industries that they track. The food industry bought below 10,000 units per year between 2013 and 2015, compared to nearly 100,000 for the automotive industry in 2015. Although, they forecast that demand from the food sector will increase.

"With increasing pressure on food and drink manufacturers of all sizes from consumers, retailers and government alike to initiate and complete product recalls for contamination (involving foreign matters and toxins); labelling errors and packaging faults in ever shorter time frames, effective product tracing for the manufacturer is imperative.

"Smart technology has a significant role to play in the food and drink manufacturing supply chain to make identification and traceability of raw materials as efficient and reliable as possible.

"The ability to track the exact source of a food's raw ingredients in as short a time as possible is critical to reduce and contain the potential impact on consumers and for the public to retain confidence both in the manufacturer, its products and the retailers to whom it supplies."

Andrew Jackson
Partner and Commercial Litigation expert at Irwin Mitchell

17 CSB System.
18 International Federation of Robotics (2016). Executive Summary: World Robotics.

"The current and likely future state of sophisticated sensor technology, connectivity and powerful analytics means that Industry 4.0 is but inevitable. Whilst the competitive advantage offered by early adoption is at present sometimes hard to identify, it will only be a matter of time before the marginal gains in productivity, efficiency and profitability accumulate to make a compelling argument for widespread acceptance."

Dorrien Peters, Partner and Head of Manufacturing at Irwin Mitchell

Advanced
manufacturing

As with previous industrial revolutions, the 'manufacturing renaissance' of Industry 4.0 is set to impact all sectors of the economy. However, the technological developments of Industry 4.0 are underpinned by innovations in the advanced manufacturing arena, where it is expected that many of the new technologies will either be developed or utilised by early adopters.

The integration of information systems and sensor technology will provide advanced manufacturers with connectivity on the factory floor that will increase flexibility and efficiency and revolutionise the production line. The use of 3D simulation and virtualisation will shorten the design-to-production cycle and transform the assembly and fabrication of complex products.

Businesses which are proactive in embracing Industry 4.0 may find themselves with an advantage over their competitors

Once adopted, the use of Industry 4.0 technologies may allow for a more efficient process for the development of products; such technologies may also provide advanced manufacturers with the flexibility to produce their products to suit the needs of individual customers.

An increase in connectivity in the supply chain will present commercial opportunities and challenges. Businesses will need to be vigilant to ensure that the value of their investment in Industry 4.0 technologies and their production-orientated big data is acknowledged and protected from unauthorised commercial exploitation and more nefarious cyber threats.

Given that Industry 4.0 technologies are set to become more commonplace, businesses which are proactive in embracing Industry 4.0 may find themselves with an advantage over their competitors. Utilisation of production technologies such as additive manufacturing which allow for product customisation may increase the customer bases of early adopters, as commercial customers will be keen to use technology effectively in their own industries.

Additive Manufacturing Technologies: embracing new opportunities

Additive Manufacturing Technologies is the world's first company focused on providing connected digital technology solutions for post-processing 3D-printed polymer parts. Using smart algorithms and machine learning, AMT's patent pending technology is able to accurately control the degree of finishing required. Founded in 2015, the company has developed its technology for a wide range of consumer products, from sports footwear to medical applications, as well as the automotive and aerospace industries.

"One of the biggest obstacles in the UK to introducing Industry 4.0 technologies are the skillsets available, and the mindset of manufacturers," says Joseph Crabtree, CEO. "Skillsets in terms of having qualified people who can transition from quite a rigid way of 'i-learning' to a more lateral way of thinking about problems; mindset in the sense that people are happy just doing things the way they always have.

> "Industry 4.0 is about looking at the entire manufacturing process and seeing how you can complete the digital process thread."

Joseph Crabtree
CEO, Additive Manufacturing Technologies

"A lot of companies have invested a lot of money in training their staff to do specific jobs," says Joseph. "These jobs create good news stories, but they do not necessarily make the company efficient, cost-effective or agile. At worst, this stifles innovation. Industry 4.0 is about looking at the entire manufacturing process and seeing how you can complete the digital process thread – removing people in manual roles, and instead upskilling them into jobs such as programming or IT.

"Perhaps this is a generational issue, but the factories of tomorrow will not contain any people, only automated processes," Joseph says. "An adage says that the factory of the future will have only two employees, a person and a dog. The person will be there to feed the dog. The dog will be there to keep the person from touching the equipment."

Investing in the future

"Not embracing Industry 4.0 is potentially a big issue for manufacturers," says Joseph. "Not taking the step to a fully automated ecosystem will mean that companies become uncompetitive and will eventually go out of business. This isn't a case of a 'nice to have', but rather a necessity. You can already see the benefits to companies, especially in countries such as Germany, who have openly adopted Industry 4.0. Companies will always find a reason not to adopt new technologies, but thinking laterally can really help.

"Recently we started recruiting for a lab technician, but the role was going to consist of many repetitive tasks. So instead of employing a person, we 'employed' a robot, or co-bot as they are known. The co-bot is now running, and although the initial capital cost is higher than a person, it will pay for itself within six to nine months. The added benefit of this is that our company now has direct access to robotics and automation."

A positive contribution

"The big misconception is that Industry 4.0 will lead to mass unemployment," Joseph says. "True, jobs that people consider 'unskilled' manual jobs today will disappear and become automated, but this is no different to the way that factory workers have been replaced by automated processes. This however provides a great opportunity to upskill people, and ultimately give them increased value-added skillsets which will increase their net worth and contribute positively to the GDP. People will also have to think more carefully about choosing careers and take steps to future-proof themselves for Industry 4.0."

Pryor Marking Technology: connecting to the future

"The essence of Industry 4.0 is simply about connecting systems and information with the aim of pooling data from across the manufacturing processes."

Alastair Morris

Sales Director, Pryor Marking Technology

Pryor Marking Technology, the trading name of Edward Pryor and Son Ltd, is a world leader in the manufacture and design of both traditional and innovative marking, identification and traceability solutions.

Founded in 1849 in Sheffield – a hub of manufacturing and the birthplace of stainless steel – the company provides solutions for all manufacturing industries, particularly aerospace and automotive. Operating from sites in the UK, USA, France and India, Pryor serves countries across the globe.

"Without doubt, there is an underlying awareness amongst manufacturing companies that they need to be exploring Industry 4.0 in order to improve productivity and remain competitive," says Alastair Morris, Sales Director. "But there is equally a lack of understanding as to what it means and what, practically, they would need to do or could do to move in that direction."

Big vision

"The general impression is of an all-singing, all-dancing, fully connected smart factory, because that is what big suppliers are presenting as the future vision of what a factory will be like," Alastair says. "In reality, that vision is so far removed from where the majority of small and medium-sized UK manufacturers are today that it feels like an impossible task, an unrealistic investment. And as there don't seem to be any small steps to start taking, the project gets shelved and no investment made.

"My message to them is not to be blinded by the big vision, but to break down what they are actually doing today and look for how they can add value, and increase productivity, with small steps."

Keeping it simple

"The essence of Industry 4.0 is simply about connecting systems and information with the aim of pooling data from across the manufacturing processes," says Alastair. "This can be done as simply as beginning to automatically log elements of the manufacturing process, data capture or a central store of elements of the process. This sort of thing can be gradually rolled out from one process to another."

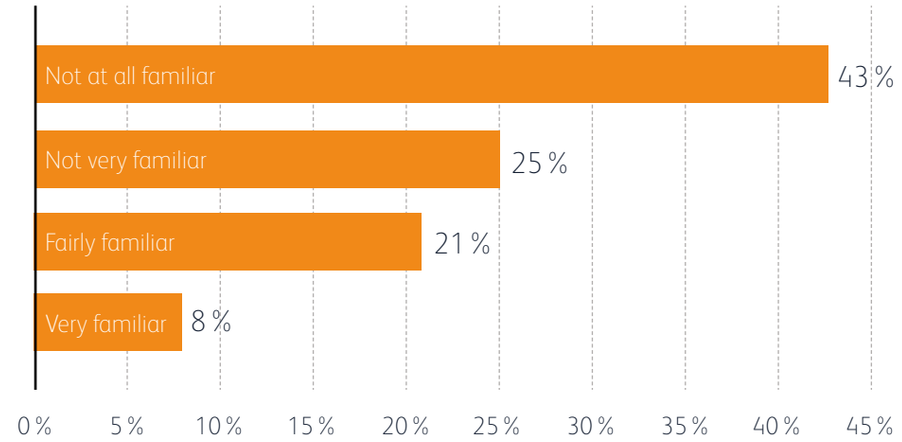
Go Fourth — Report insights

For the purpose of this report, Irwin Mitchell commissioned a bespoke survey, with a total sample size of 292 senior decision makers in private sector manufacturing. The fieldwork was undertaken by YouGov in an online survey.

Awareness
of Industry 4.0

Despite the growing importance of automated processes, technologies and robotics in industry, only one in three manufacturers are familiar with the application of Industry 4.0. Moreover, the awareness of Industry 4.0 differs significantly with company size. Only two in 10 small companies[19] classified themselves as being familiar with Industry 4.0 while almost half of all medium-sized firms[20] are familiar with the application of Industry 4.0 in the manufacturing industry.

Figure 2 *– Industry 4.0 familiarity*



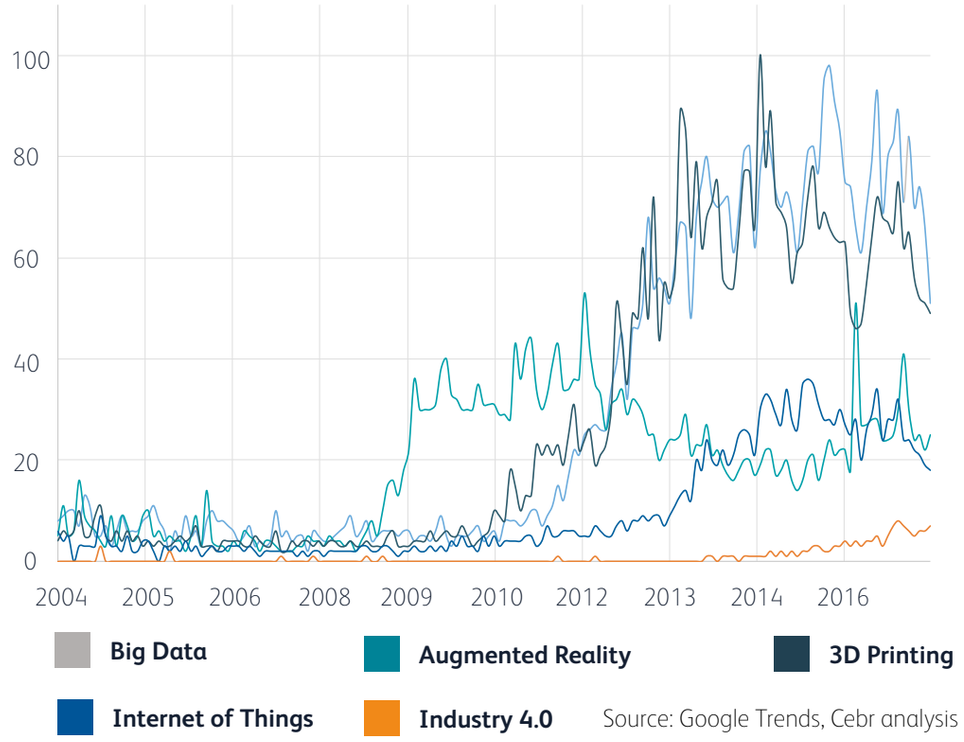
Source: YouGov survey, Cebr analysis

The use of the term Industry 4.0 has increased significantly over the past five years, highlighting the growing importance of automated processes and technologies. Data from Google Trends highlights a consistent upward trend in individuals looking up the term Industry 4.0 since 2014. However, interest peaked in March 2017 and has remained broadly stable over the past few months.

19 Refers to businesses with less than 50 employees.
20 Refers to businesses with 50 to 249 employees.

That said, individuals may search for other terms when gaining information on Industry 4.0. A business considering introducing fully autonomous robots for example is likely to specifically search for information on this technology. Figure 3 provides an overview of how interest in various technologies developed over time. The value is an index number where numbers represent search interest relative to the highest point on the chart for the given region and time. It can be seen that awareness of big data and 3D printing has grown significantly since 2011, with Internet of Things and augmented reality having fewer Google searches. The index for Industry 4.0 searches is much lower, reflecting the fact that businesses are more likely to search for the specific technology, rather than the general Industry 4.0 term.

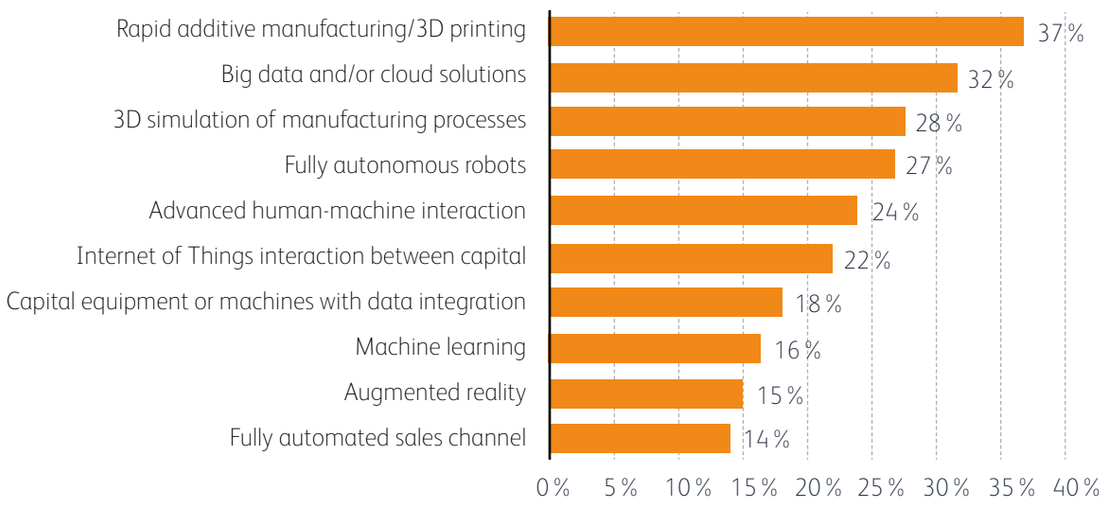
Figure 3 *– Google search UK interest in Industry 4.0 technology*



Source: Google Trends, Cebr analysis

Roughly one third of manufacturers are familiar with rapid additive manufacturing and 3D printing (using layers of material under computer control to create an object) as well as big data and cloud solutions (involved in retrieving resources from the Internet through web-based applications, rather than through a direct connection to a server). Figure 4 shows that one in four manufacturers are familiar with 3D simulation of manufacturing processes, fully autonomous robots and advanced human-machine interaction.

Figure 4 *– Share of private sector manufacturers familiar with Industry 4.0 technologies*



Source: YouGov survey, Cebr analysis

Investment

in Industry 4.0

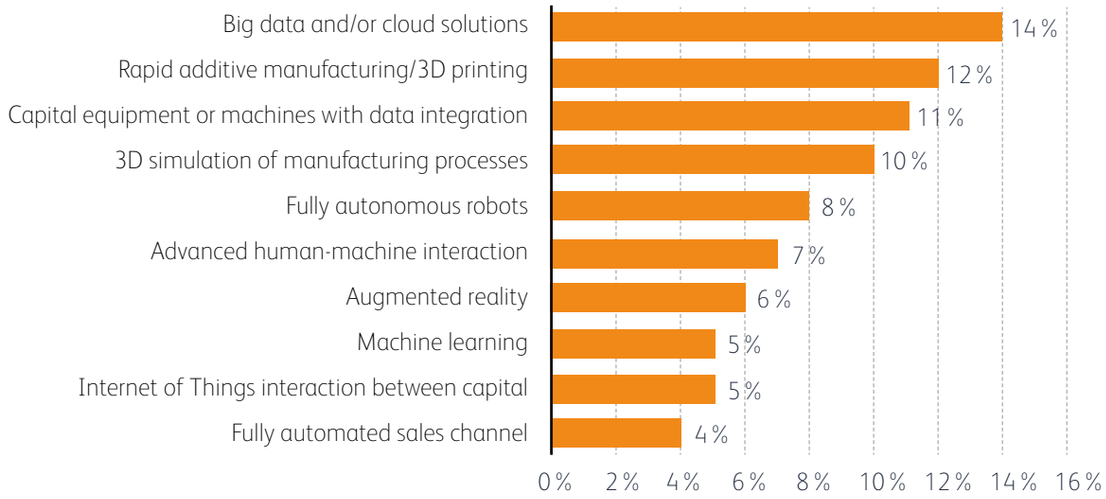
Despite a relatively low awareness of the term Industry 4.0, the survey findings also reveal that one in four companies have invested in Industry 4.0 specific technologies in the past. Big data and cloud solutions were the most common technologies manufacturers have invested in, with 14 % of businesses having invested, followed by rapid additive manufacturing and 3D printing at 12 %. Fully automated sales channels have received the least investment.

Most firms who are investing have spent less than £100,000 on Industry 4.0 technology thus far, with the average investment per business being £99,000. Only 1 % have spent more than £1,000,000. This is surprising given the fact that new technology tends to be very expensive. However, it may reflect a trend towards firms investing in the cheaper technology available now, and waiting longer for the more expensive technologies, hoping that their price will fall. Technology prices often fall over time as research and development of cheaper production methods is carried out. Total worldwide industrial investment in Industry 4.0 technology is expected to be $907 billion per year until 2020[21].

Total worldwide industrial investment in Industry 4.0 technology is expected to be $907 billion per year until 2020

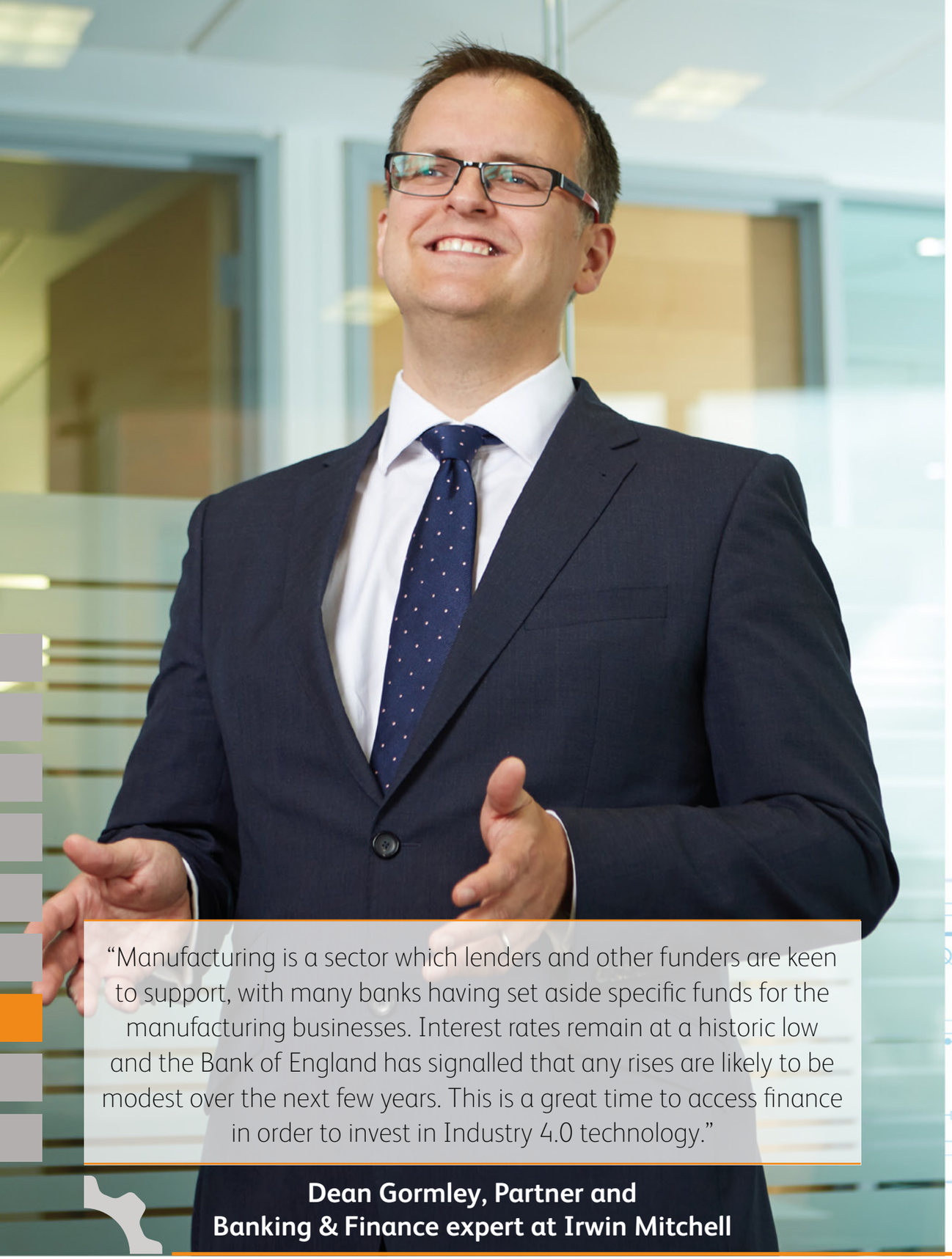
There is some divergence by company size in regards to Industry 4.0 investment, with the share of small businesses[22] that have invested in those technologies standing at just 26 %. The respective share for medium-sized enterprises[23] meanwhile stands at 60 %, highlighting how larger companies are more likely to invest. Companies may be using big data and cloud solutions more than other technologies because they are cheaper and easier to purchase. A small firm might pay around £30,000 a year for Amazon cloud solutions[24], which can be signed up for in minutes, whereas prices for a robot would likely be above £100,000 (depending on its use)[25]. Larger companies are likely to have a bigger budget for technology improvements and so can be expected to adopt new technology before their smaller peers. 38 % of small-sized enterprises said that they were too small to capitalise upon the benefits of Industry 4.0 technologies, whereas only 23 % of medium-sized firms said that this was a discouragement.

Figure 5 *– Share of private sector manufacturers that have invested in Industry 4.0 technologies*



Source: YouGov survey, Cebr analysis

21 PwC (2016) Industry 4.0: Building the digital enterprise.
22 Companies with less than 50 employees.
23 Companies with 50 to 249 employees.
24 Amazon Web Services.
25 RobotWorx.



"Manufacturing is a sector which lenders and other funders are keen to support, with many banks having set aside specific funds for the manufacturing businesses. Interest rates remain at a historic low and the Bank of England has signalled that any rises are likely to be modest over the next few years. This is a great time to access finance in order to invest in Industry 4.0 technology."

Dean Gormley, Partner and Banking & Finance expert at Irwin Mitchell

Challenges and opportunities
of Industry 4.0

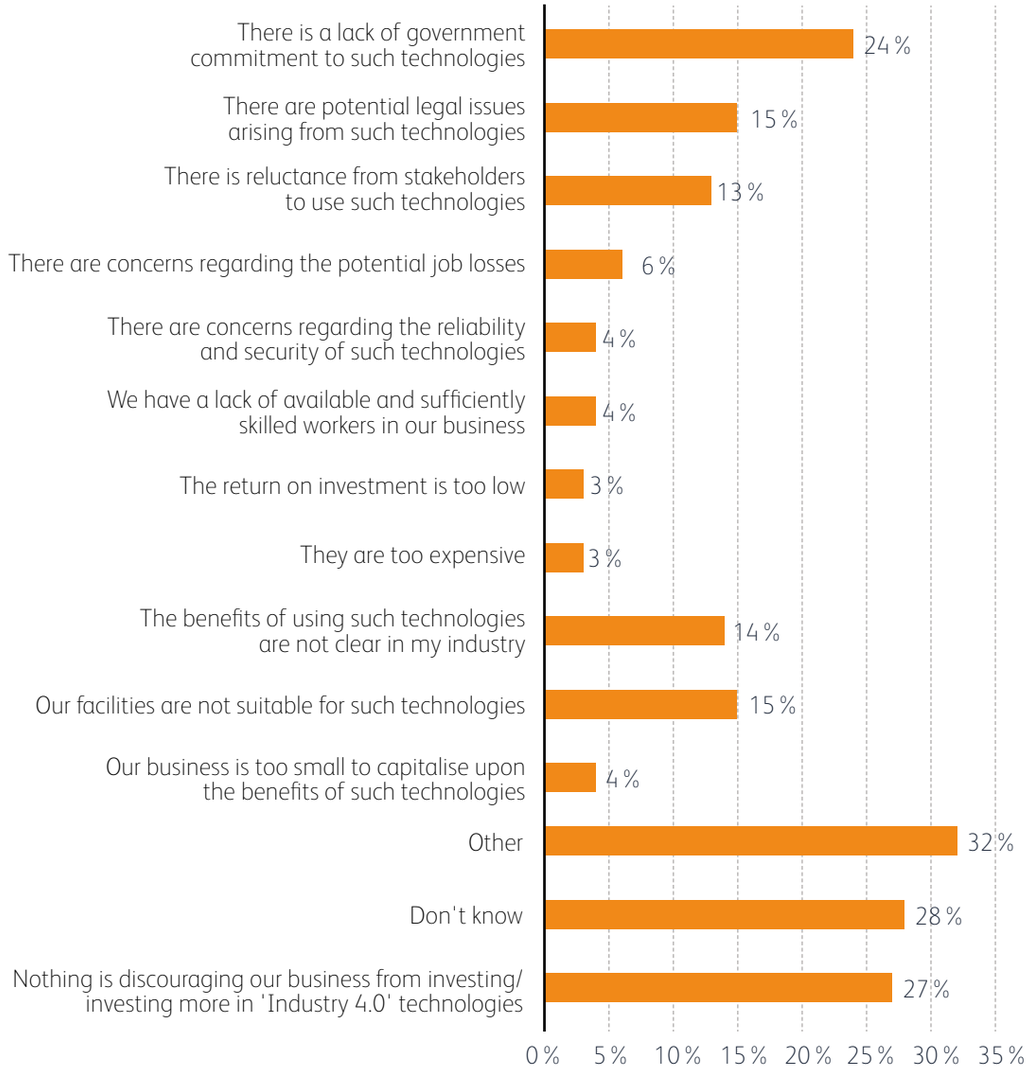
Although companies may be willing to invest in Industry 4.0 technologies, there are several factors that discourage them from doing so, as shown in Figure 6 (overleaf). Almost one third of companies believe that their business is too small to capitalise upon the benefits of such technologies, with one in four firms stating that it is too expensive to invest in Industry 4.0 and more than one in six firms commenting that the return on such investments is too low.

Despite the financial issues, skill shortages are also a barrier to companies investing in these technologies. Around 13 % of firms indicated that there is a lack of available and sufficiently skilled workers within their business.

Another reason as to why firms may not invest is possible legal implications, with 26 % anticipating IT security issues, and 22 % citing malware or virus concerns.

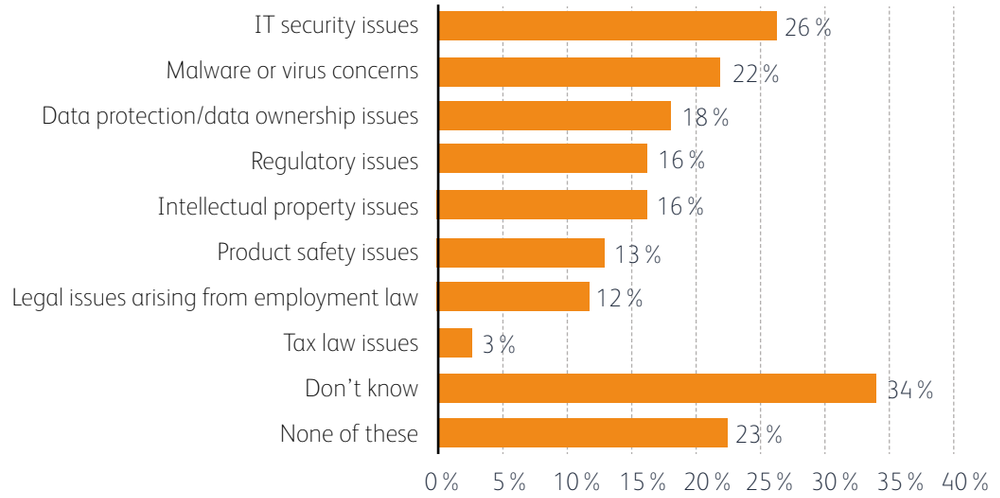
Skill shortages are a barrier to companies investing in these technologies

Figure 6 *– Reasons why private sector manufacturers are not investing in Industry 4.0 technology*



Source: YouGov survey, Cebr analysis

Figure 7 *– Legal issues which private sector manufacturers anticipate will arise as a result of Industry 4.0*



Source: YouGov survey, Cebr analysis

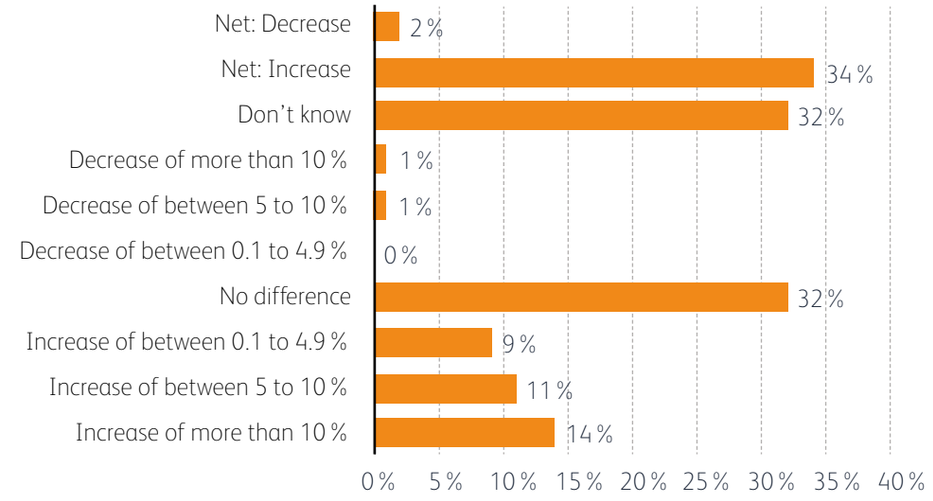
"According to our research, only four out of 10 manufacturing firms have started preparing for the new General Data Protection Regulation (GDPR). The fines for non-compliance are up to 4 % of global turnover, so if businesses fail to get it right, the benefits of Industry 4.0 will be quickly wiped out.

"The opportunities for manufacturers to take advantage of the big data revolution and embrace Industry 4.0 to become more profitable are real. This is forcing manufacturers to improve the connectivity of their businesses. Good data governance is a crucial part of this - indeed it will be essential to achieve the future state of a digitally integrated supply chain."

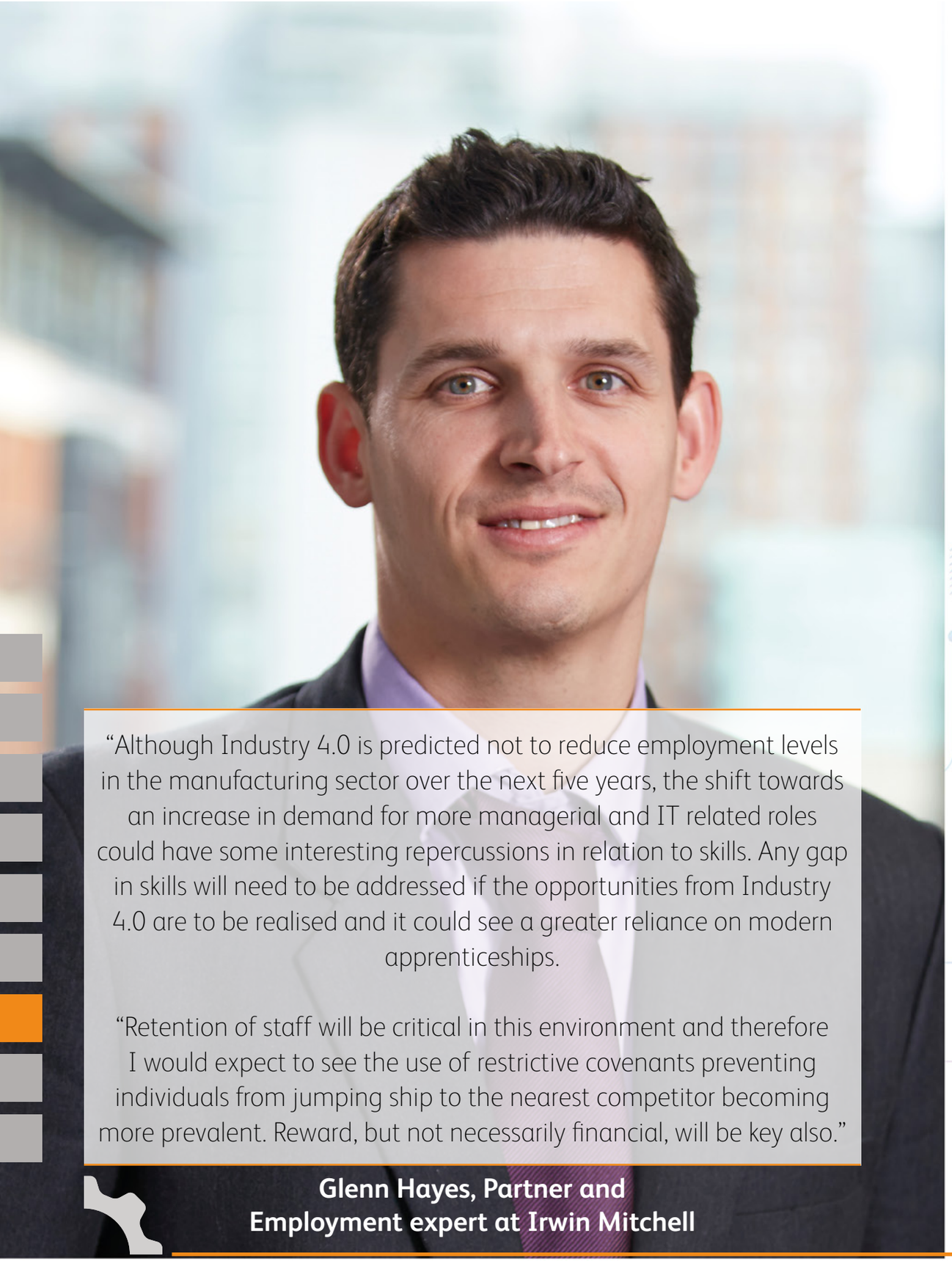
Joanne Bone, Partner and Data Protection expert at Irwin Mitchell

Companies find themselves in a tricky situation. On the one hand, there is a large number of manufacturers expecting Industry 4.0 related technologies to lead to productivity gains, shown in Figure 8. On the other hand, there is a belief that automated and robotic processes, smart factories and Industry 4.0 will have a negative impact on jobs over the next 10 years (further analysed in the next section).

Figure 8 *– Anticipated effect of Industry 4.0 on productivity for private sector manufacturers*



Source: YouGov survey, Cebr analysis



"Although Industry 4.0 is predicted not to reduce employment levels in the manufacturing sector over the next five years, the shift towards an increase in demand for more managerial and IT related roles could have some interesting repercussions in relation to skills. Any gap in skills will need to be addressed if the opportunities from Industry 4.0 are to be realised and it could see a greater reliance on modern apprenticeships.

"Retention of staff will be critical in this environment and therefore I would expect to see the use of restrictive covenants preventing individuals from jumping ship to the nearest competitor becoming more prevalent. Reward, but not necessarily financial, will be key also."

Glenn Hayes, Partner and Employment expert at Irwin Mitchell

Predicted impact

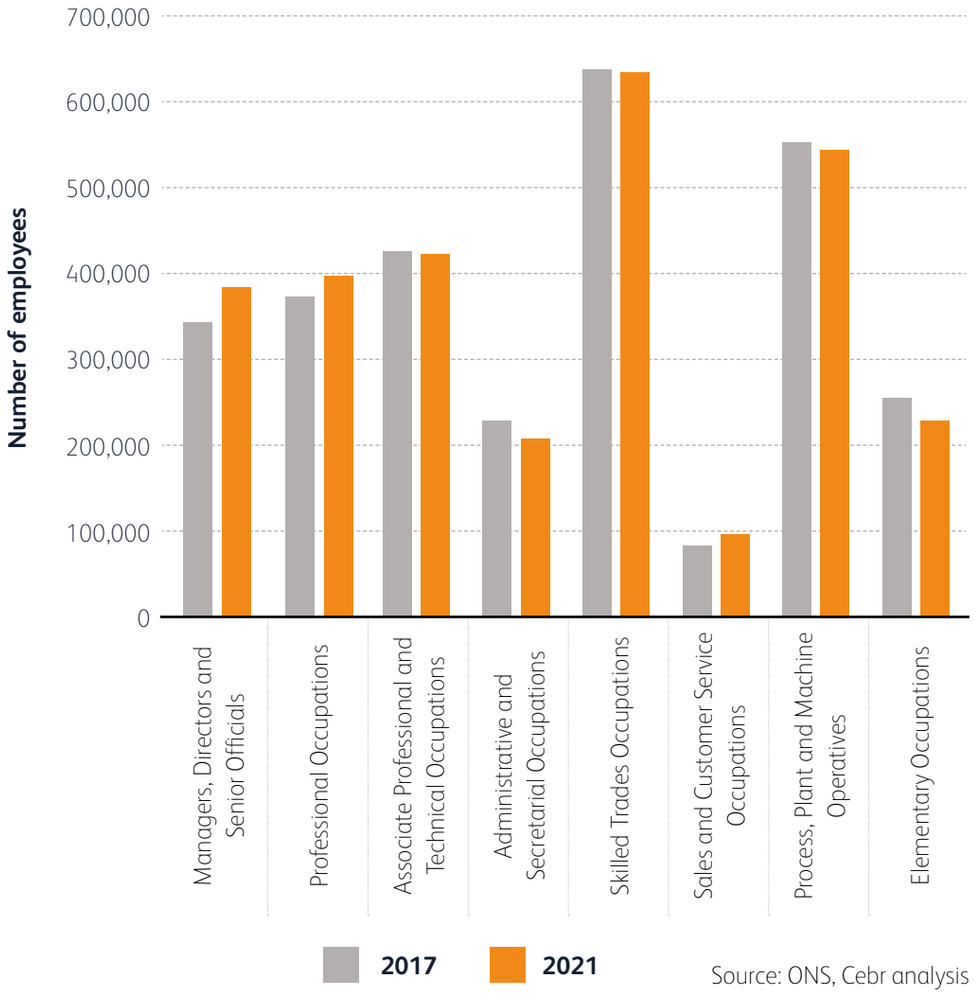
on employment by occupation

A net balance of 10 % of manufacturers reported that the use of Industry 4.0 technologies has had a positive impact on overall employment within their businesses. This is consistent with other research. The BCG[26] finds that German manufacturing can see a 6 % increase in employment due to Industry 4.0. The International Federation of Robotics finds that less than 10 % of jobs are fully automatable, meaning that robots can be used to complement existing worker activities rather than complete them entirely. There is also an increased demand for workers within the IT sector resulting from Industry 4.0 which is likely to outweigh the number of jobs lost because they can be fully automated.

10 % of manufacturers reported that the use of Industry 4.0 technologies has had a positive impact on overall employment within their businesses

26 Boston Consulting Group (2015). The Robotics Revolution.

Figure 9 *– Predicted change in manufacturing employment between 2017 and 2021 by occupation*



Source: ONS, Cebr analysis

Figure 9 shows the level of employment in different professions within the manufacturing sector in 2017, and the Cebr forecast for 2021. These forecasts were calculated using historic growth rates from the labour force survey for the number of jobs within manufacturing, by occupation type. We generated these predictions using the Cebr private sector employment model. The model takes account of considerations including demographic changes based on fertility, mortality and migration trends, domestic demand, demand from key export markets, government investment and the policy environment.

The forecast for the change in overall manufacturing employment predicts that in 2021 there will be 2.93 million jobs, a 0.8 % increase from 2.91 million in 2017. This dispels the common fear that technological advancement results in fewer jobs.

Industry 4.0 will not affect aggregate employment significantly, but will cause a swing in employment towards higher skilled professions

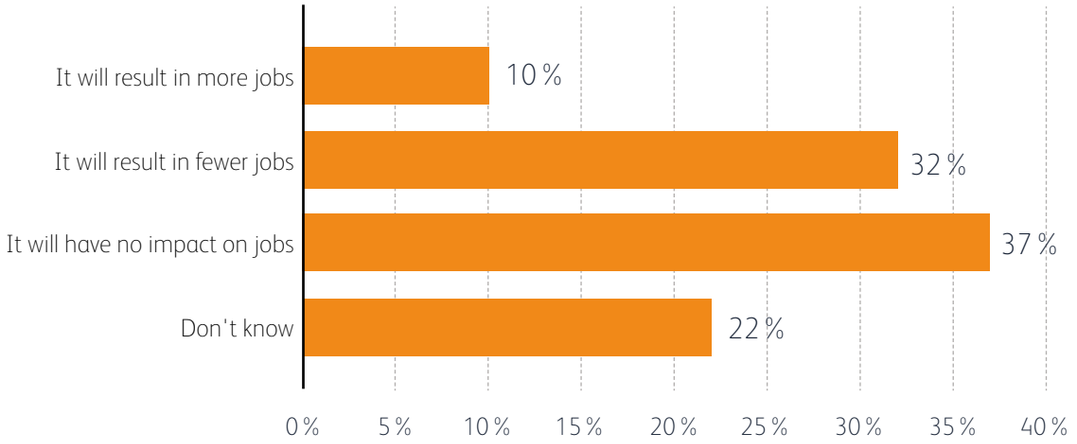
The distribution of jobs within manufacturing will change. This analysis finds that lower skilled professions or those which can be automated more easily will see a decline in the level of employment. Administrative and secretarial jobs are expected to decline by 10 % between 2017 and 2021. Also, process, plant and machine operatives decline by 1 % and elementary occupations by 10 %. Managerial and more skilled professions are set to see a rise in the level of manufacturing employment. We anticipate a 12 % increase in managers, directors and senior officials between 2017 and 2021, and a 7 % rise for professional occupations.

More unexpectedly, the number of jobs in skilled trades is expected to decline slightly, by 0.7 % between 2017 and 2021. However, as robots become more developed, skilled jobs which may have previously been thought of as safe from being automated will be replaced. For example, the BBC calculator[27] for the probability of automation for different jobs finds that accountants have a 95 % probability of automation.

These findings reflect the view that Industry 4.0 will not affect aggregate employment significantly, but will cause a swing in employment towards higher skilled positions. Managers and professionals skilled in technology and robotics will experience a growth in employment while repetitive, low skilled jobs are more likely to become automated.

27 BBC (2015). Will a robot take your job?

Figure 10 *– Predicted change in manufacturing employment over the next 10 years as a result of Industry 4.0: private sector manufacturers survey results*



Source: YouGov survey, Cebr analysis

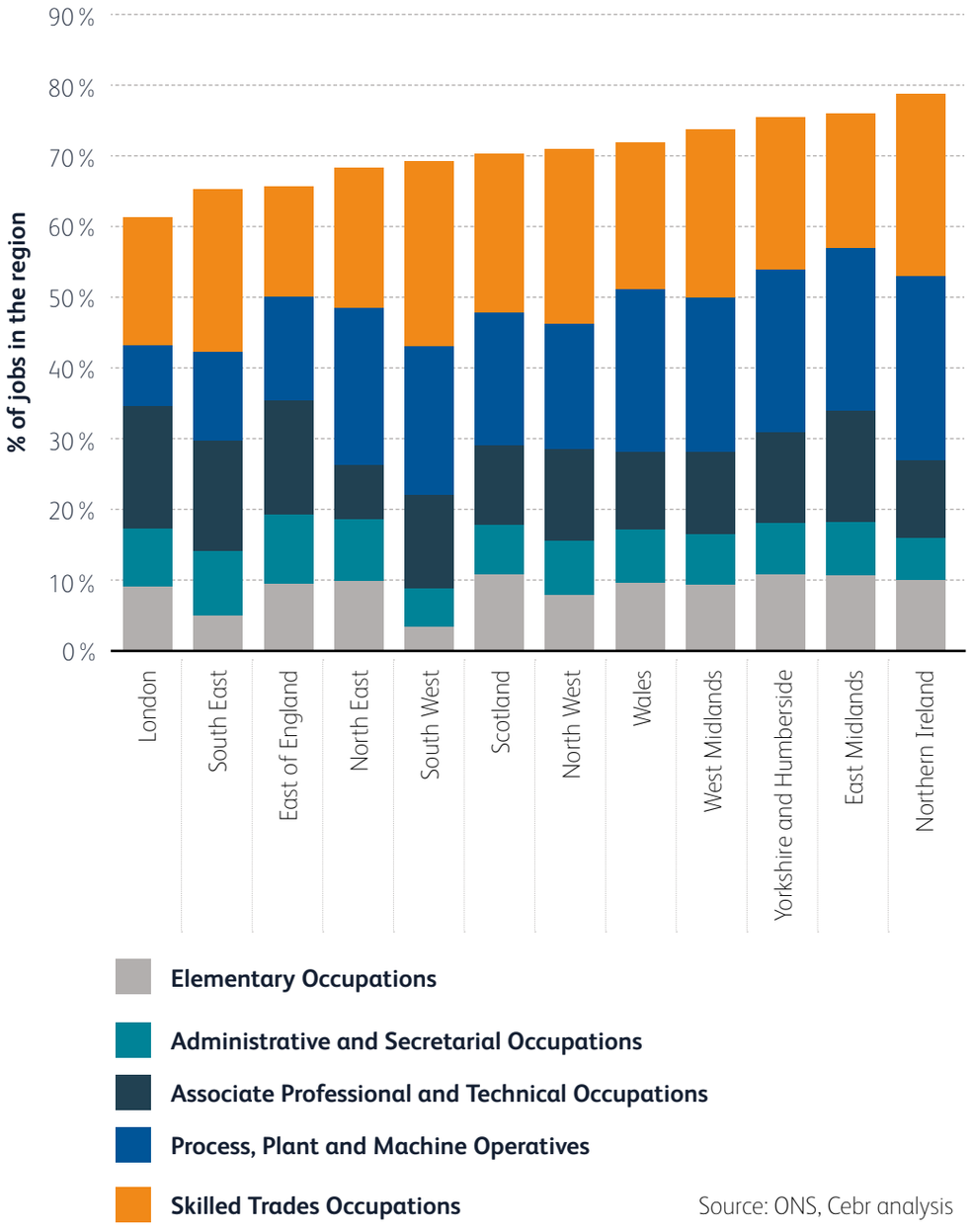
The forward looking survey results in Figure 10 show a slightly different story, with 32 % of firms believing that Industry 4.0 will result in fewer jobs. However, 37 % anticipate that overall Industry 4.0 will have no impact on jobs, as the Cebr forecast predicts overall. The high number of firms which expect a fall in employment may suggest that some manufacturers are not accounting for the increase in employment that Industry 4.0 will cause in IT and managerial positions, which our forecasts show.

11 % of medium-sized firms believe that Industry 4.0 will result in more jobs, whereas only 7 % of small firms do. Since small firms are unlikely to employ their own IT specialists, which is where a lot of the potential for growth is, they may not expect to see an increase in employment. Whereas, medium and large firms will be anticipating employing more specialists to run their technology.

Medium and large firms will be anticipating employing more specialists to run their technology

Cebr has also analysed manufacturing employment data to uncover how Industry 4.0's impact on employment will vary by region. According to Cebr's forecasts, manufacturing employment over the next four years will reduce for the following occupations: elementary occupations, administrative and secretarial occupations, associate professional and technical occupations, process, plant and machine operatives and skilled trades occupations. Figure 11 (overleaf) shows where these occupations are most concentrated.

Figure 11 *– 2017 regional breakdown of manufacturing sector jobs which are expected to reduce employment*



Source: ONS, Cebr analysis

As shown, the East Midlands and Northern Ireland employ the highest percentage of at-risk occupation groups, while London and the South East employ the least. For example, in the South East, only 5 % of jobs are elementary occupations (for which employment is expected to decline by 10 % by 2021), while the figure for Yorkshire and Humberside is 11 %. Also, in the East Midlands, 23 % of jobs are process, plant and machine operatives, but in London only 9 % of manufacturing workers are employed in this sector.

These regional results suggest that Industry 4.0 will generate a change in the distribution of manufacturing jobs within the country. Aggregate employment is not forecast to change significantly, and the job creation will occur in areas with more employment of managers and professional occupations, of which there are a higher proportion in London and the South East.

Industry 4.0 will generate a change in the distribution of manufacturing jobs within the country

Conclusions

The research presented in this report shows that in the UK, usage of and familiarity with Industry 4.0 technology is at a low level in the manufacturing sector; however it is growing, especially within cloud solutions and big data analytics which 14 % of British manufacturing firms have invested in. This growth will provide productivity benefits, with 34 % of firms expecting output to increase as a result of Industry 4.0.

Many manufacturing businesses in the UK are still concerned by the cost of investing in Industry 4.0 technology, especially more expensive technologies such as augmented reality and machine learning. Also, a number of businesses believe that their cyber security would be threatened by Industry 4.0, as the survey results show that 26 % of firms predict IT security issues.

While one in three businesses surveyed believe that Industry 4.0 will reduce employment in the next decade, Cebr forecasts expect that on aggregate, employment will be stable until 2021. However, there will be a reduction in low paid, automatable jobs and an increase in IT and managerial roles. Industry 4.0 technologies are often complementary to many conventional roles, and so will not cause significant overall unemployment as some manufacturing businesses fear.

Points to consider

for businesses

Review your data protection compliance and information security protocols. Get compliant with GDPR and use it as an opportunity to improve your data retention.

Run different cyber security scenarios and make sure you are protected. Don't assume that you are not a target.

Speak to banks and other lenders about access to funding and look to see how you can take advantage of current interest rates.

Review your employment contracts to ensure the appropriate restrictive covenants are in place in order to protect your IP.

Assess whether you have a skills gap and take action to close it by identifying your needs now.

Run an Intellectual Property health check to ensure you are protected.

Consider your company's inefficiencies – can these be improved upon by Industry 4.0 technologies?

Key contacts

While **Industry 4.0** presents significant challenges for businesses, it also offers huge potential benefits for companies that prepare well. **Speak to one of our experienced lawyers today and let them help you take advantage.**

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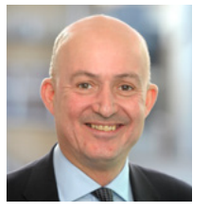

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This report has been produced by Cebr, an independent economics and business research consultancy established in 1992. The views expressed herein are those of the authors only and are based upon independent research by them.
London, October 2017

Only four in **10** manufacturing firms have started preparing for the new General Data Protection Regulation (GDPR), which comes into force on **25 May 2018**

"The opportunities for manufacturers to take advantage of the big data revolution and embrace Industry 4.0 to become more profitable are real, and this is forcing manufacturers to improve the connectivity of their businesses. Good data governance is a crucial part of this - indeed it will be essential to achieve the future state of a digitally integrated supply chain."

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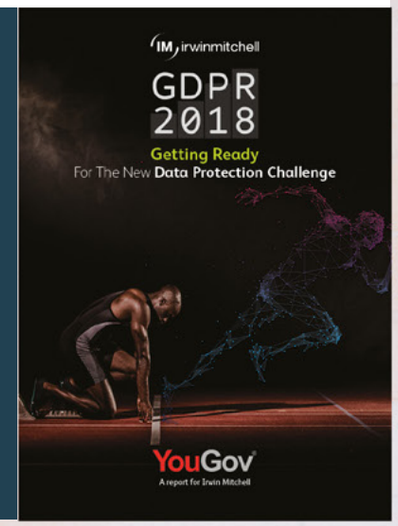
Our data protection experts can help you over the finish line.



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