



An Industry 4 readiness assessment tool

In association with

Crimson&Co*


Pinsent Masons

Contributors

Crimson&Co*

Crimson & Co is a global management consultancy that specialises in the supply chain. We help clients achieve their strategic and operational objectives, working together to transform their businesses and generate lasting change. Our people have operational experience, are easy to work with and are trusted by clients to get the job done. Crimson & Co has offices in London, Atlanta, Mumbai, Melbourne, São Paulo and Singapore.

Supply chains constantly evolve, and Industry 4.0 is the latest step in this journey. Through the increase in digitalisation, we will see machines and computers talking to each other to change production plans and resource usage in the most effective way to meet changing customer demands in the most efficient manner. To achieve this and sustain it though, there will need to be a step change in the way that companies manage their data, organise themselves, conduct their basic supply chain processes, measure performance on both an individual and company-wide level, and share information, both internally and with supply-chain partners. These changes require not just investment in technology, but substantial cultural and capability adjustment.

As experts in technical elements of the supply chain and in driving sustainable transformation, Crimson & Co works with companies from a wide range of sectors and locations to assess the changes they need to make, design all elements of the change required, and firmly embed the changes into their operations.



Pinsent Masons

Pinsent Masons is a full service, international law firm. We respond to the pressures and opportunities facing businesses globally with legal excellence, connectivity and collaboration. We use law and litigation strategy as a business enabler to deliver clients a competitive edge. In 2015 our culture of innovation led to the Financial Times naming us Europe's most innovative law firm.

As a top 75 global law firm, Pinsent Masons has just over 400 partners and 1600 lawyers operating across 22 offices worldwide. The quality of our lawyers is second to none. Pinsent Masons has more Tier 1 ranked practices and top ranked lawyers in Legal 500 and Chambers than any other UK law firm, including all 4 magic circle firms.

Businesses within the Manufacturing and Industrials sectors are well primed for growth and evolution due to the emergence of the fourth industrial revolution. Industry 4.0 has placed an ever increasing need to embrace technology in areas such as smart factories; 3D printing and the Internet-of-Things. However, despite its technological advantages, Industry 4.0 does present a series of new legal challenges that need to be addressed in order to enable the sector to remain competitive in international markets.

We use our legal and commercial expertise to provide guidance that helps clients achieve competitive success, maximise their assets and minimise complexity and risk within product lines, customer relationships, manufacturing operations and supply chains. Our legal advice and support to clients is driven by an unparalleled understanding of the global manufacturing market and underpinned by a presence across the UK and Europe and the Asia Pacific region.



THE UNIVERSITY OF WARWICK

We adopt a practical, problem-centred approach to our supply chain and operations research, using supply chain strategy as a lever for business transformation. Working with industry partners, we bring academic rigour to the resolution of complex business and organisational problems.

The diversity of our partners means we have impact across sectors including agrochemicals, automotive, defence, consumer-packaged goods, retail, and pharmaceuticals. Current research areas include the circular economy, customer responsive supply chains, right-shoring, data driven decision making, and offsets and economic engagement.

Our innovative research and the industrial expertise of our teaching staff, helps to inform our postgraduate education, including both full and part-time MSc programmes. We also support PhD and EngD candidates within our expert research teams.

Our Supply Chains in Practice networking events and industrial collaborator forum engage practitioners across sectors and disciplines. Through quarterly meetings, we embed and develop customer responsive supply chain theory into practical solutions to turn rhetoric into reality. Our collaborator forum is an invited group of forward thinking companies, whilst our networking events are open to the wider supply chain community to attend.

Industry 4: How ready is your business?

The term Industry 4 originates from the high-tech strategy of the German government, which sought to re-define the role of manufacturing post the global economic crisis. It suggests that we are on the cusp of the 4th Industrial Revolution, a cyber physical age, which will be realised over the next 20 years. It is an age in which materials and machines are inter-connected within the internet of things (IoT), where everyday objects have network connectivity, allowing them to send and receive data. This will enable highly flexible, individualised and resource friendly mass production. It is driven by a requirement for shorter time to market, increased flexibility and greater asset efficiency.

More fundamentally it will create new business models that will drive both evolutionary and revolutionary changes to the way in which we do business today. Businesses cannot afford to stand-still. Based on research at WMG, the University of Warwick, in conjunction with our industrial collaborators Crimson & Co and Pinsent Masons, an Industry 4 readiness assessment tool has been developed. Its purpose is to provide a simple and intuitive way for companies to start to assess their readiness and future ambition to harness the potential of the cyber-physical age.

The readiness assessment tool is comprehensive in its nature. It looks beyond the technology to consider 6 core dimensions, with 37 sub-dimensions of industry 4 readiness. The core dimensions include:

- ▶ **Products and services**
- ▶ **Manufacturing and operations**
- ▶ **Strategy and organisation**
- ▶ **Supply chain**
- ▶ **Business model**
- ▶ **Legal considerations**

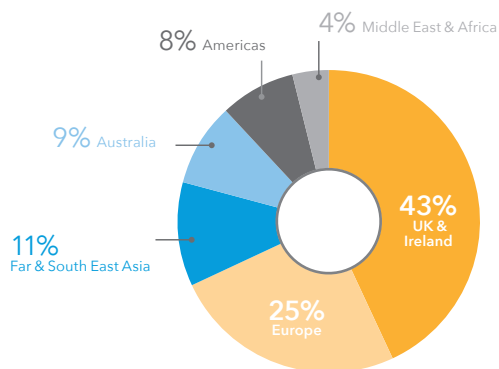
Drawing on Crimson & Co's expertise in developing supply chain maturity assessment tools, the assessment is designed around four readiness levels (beginner, intermediate, experienced and expert). They have explicit statements of what needs to be achieved to reach that particular level of readiness for each sub-dimension.

This report has been designed to enable you to complete a self-assessment of your company's current Industry 4 readiness, whilst providing a benchmark of current Industry 4 readiness across a group of 53 companies.

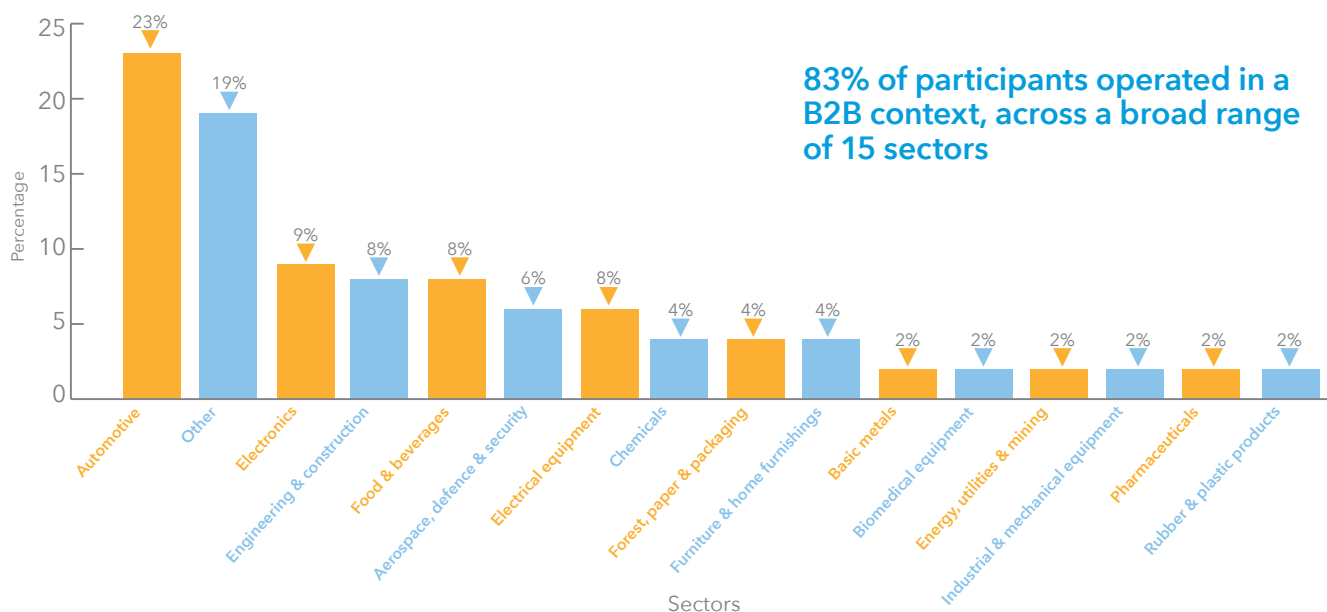
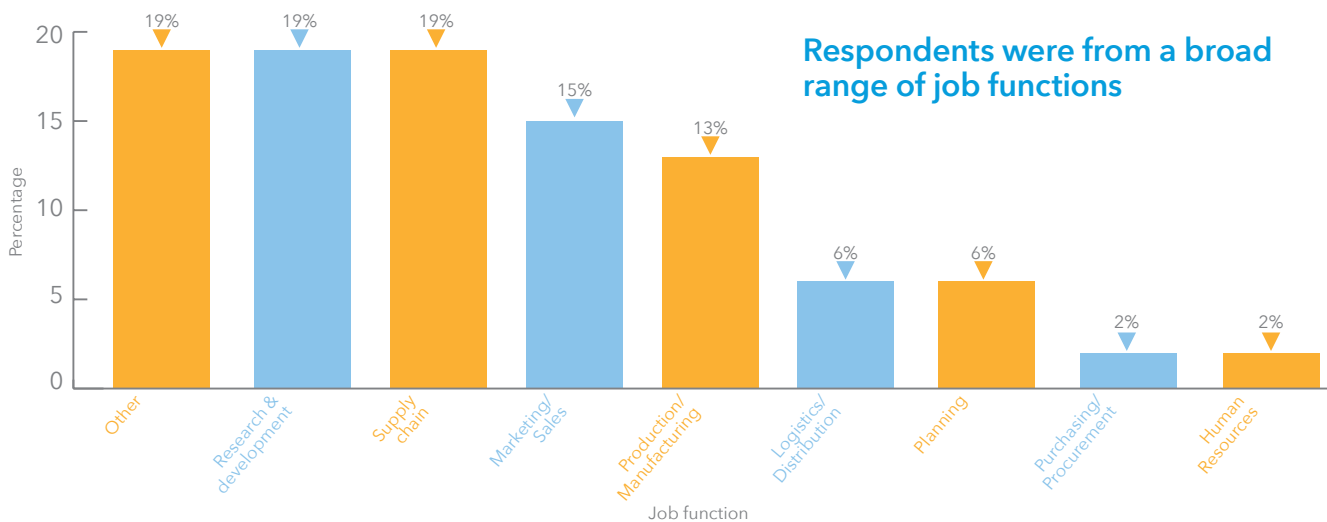
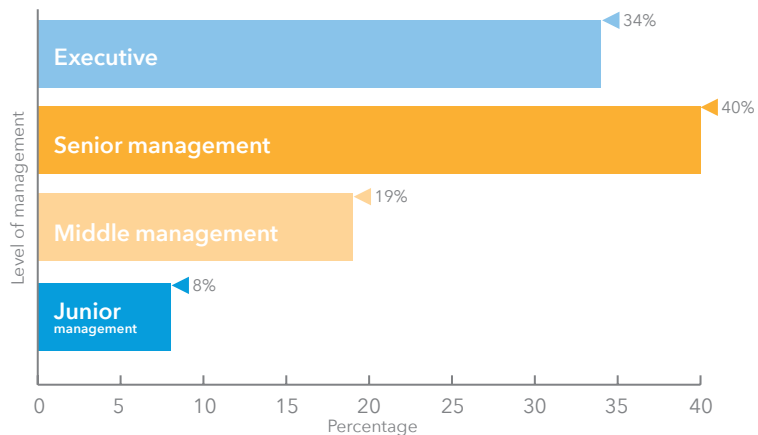
The report is structured around each of the 6 core dimensions. For each dimension, there is a detailed breakdown of the relevant sub-dimensions and descriptions for the associated maturity levels. By circling the descriptor that best describes your company's current level of readiness, and using the summary templates on pages 18 and 19, you can start to build a picture of your company's current Industry 4 readiness. This can be repeated to reflect your company's future ambition, and the gaps between current and future ambition identified. The assessment can be completed individually or as a group. It serves as a basis for enriching and expanding the discussion to help ensure that businesses are proactively harnessing the opportunities that the cyber-physical age presents.

Who completed the survey?

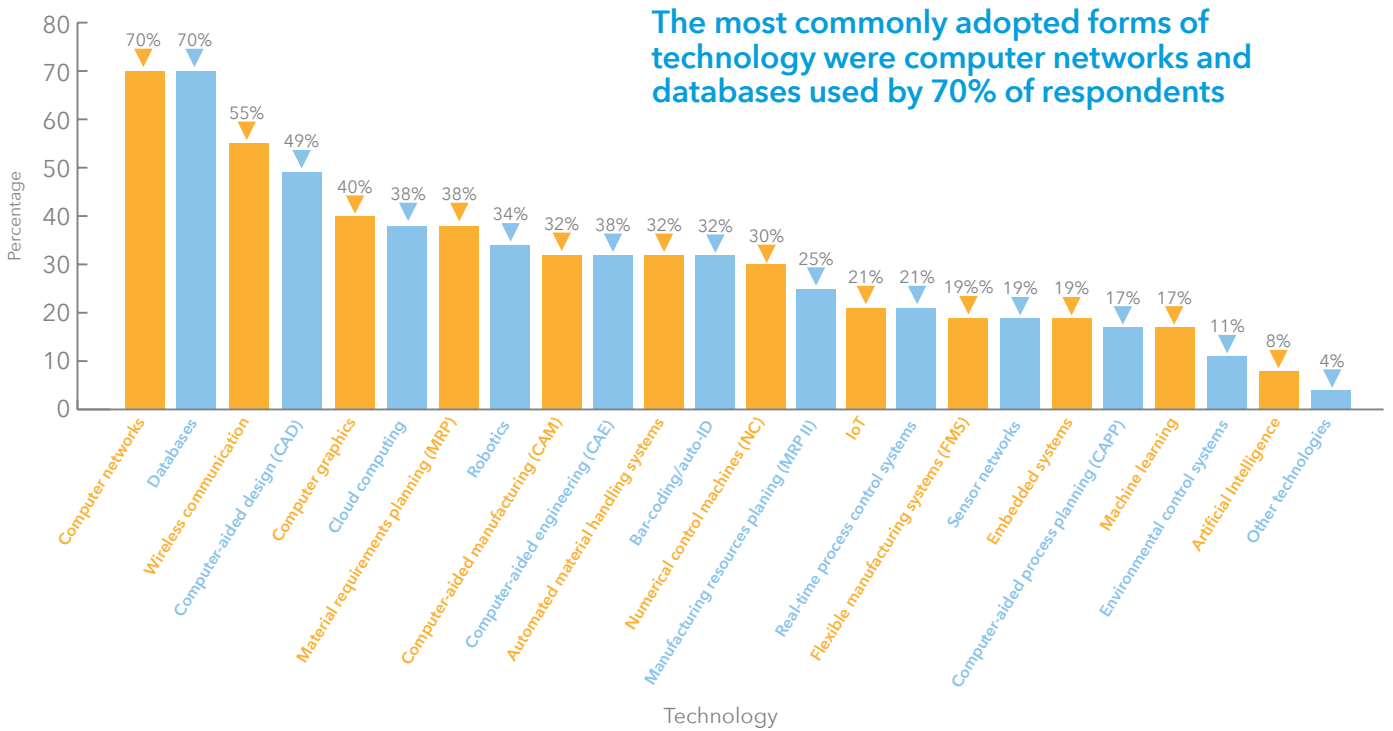
53 responses from 22 countries
Geographical scope



74% of respondents were senior management or executives
Level of management



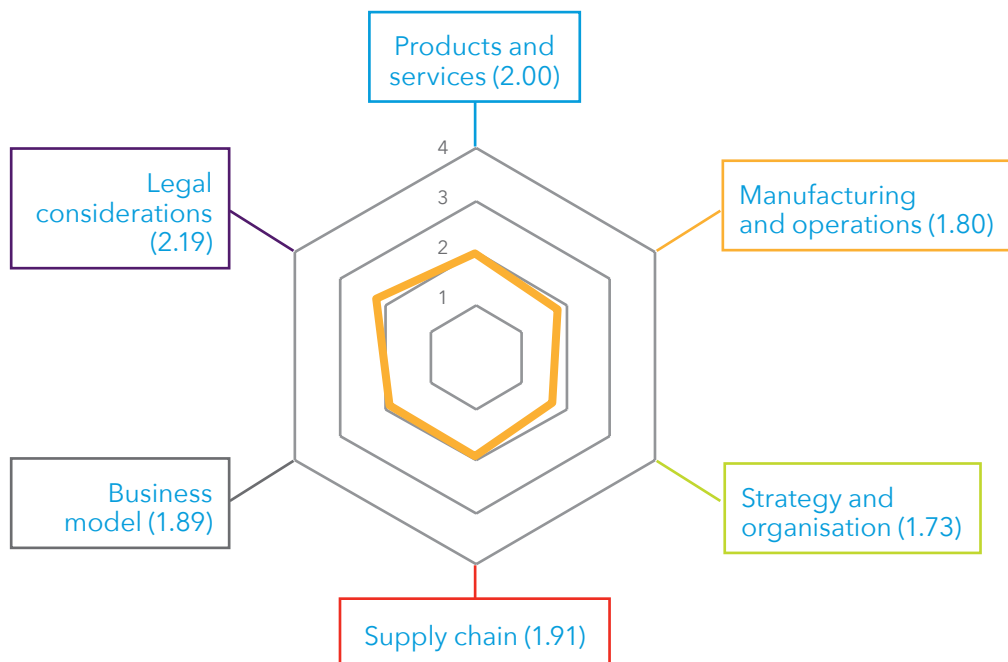
Technology adoption



Overall readiness

Companies were generally at an intermediate level (level 2) of Industry 4 readiness, with strategy and organisation being the least ready, and legal considerations the most ready.

Overall Industry 4 readiness levels



Readiness levels: Level 1 - Beginner • Level 2 - Intermediate • Level 3 - Experienced • Level 4 - Expert

Products and services

Industry 4: blurring the lines between products and services

Over the last 20 years there has been an increasing recognition that the distinction between a physical product and a pure service are blurring. With the opportunity to provide greater connectivity to products through IoT technology, the cyber-physical age offers greater opportunity replace the purchase of a product with a service. HP Instant Ink is a subscription based business model. It guarantees the user the ability to print an agreed number of pages per month, for a set fee, and that they will never run out of ink. Pages printed, and ink usage are monitored through the IoT enabled printer. The customer still pays for the printer, but the actual printing is a service. This service offers good value to the consumer (annual printing costs are significantly reduced) and to the company (as they have better visibility of demand, direct relationship to the consumer and a more consistent income stream). It also has potential benefit to the environment as recycling the ink cartridges in a closed-loop is an integral part of the business model. It's a win-win.

Customers value choice, and whilst some may be happy to engage with subscription based services, others will continue to favour ownership of a physical product. There is no single right answer, but it is important for businesses to be aware of the opportunities. HP still sells conventional printers and ink, as well as the Instant Ink service. To harness the potential of the cyber-physical age, an understanding of the art of the possible is essential.

Sub-dimensions

One of the central tenets of the Industry 4 vision, is the presumption that a 'batch size of 1' can be produced at the same unit cost as a mass-produced product. This follows from the view that in the future customers will value increasing levels of **product customisation**. Achieving this goal will require new approaches to the late differentiation of products. An alternative way that this goal can be achieved is to keep the physical product base standardised, but enable the customisation of the product through **digital product features**. No two smartphones, even when the brand and model are common, are the same. They have been customised not only in terms of protection (cover, screen protector) but more fundamentally in terms of the apps and settings. This then affords the opportunity to connect with the customer to offer **data driven services**. For a smartphone this could be cloud based storage, music, maps etc. A digitally enabled device will also enable the collection of user-data which can then be used to offer more value adding services (**product data usage**). Ultimately what this can lead to is a business model where the revenue is split between the revenue for the initial purchase of the physical product, and the ongoing revenue from the value-adding services. The trend is for the **share of revenue** from data-driven services to increase.

Readiness level	Level 1 Beginner	Level 2 Intermediate	Level 3 Experienced	Level 4 Expert
Product customisation	Product allows for no individualisation, standardised mass production	Majority of products are made in large batch sizes with limited late differentiation	Products can be largely customised but still have standardised base	Late differentiation available for most make-to-order products (batch size 1)
Digital features of products	Products show only physical value	Products show value only from intellectual property licensing	Products exhibit some digital features and value from intellectual property licensing	Products exhibit high digital features and value from intellectual property licensing
Data-driven services	Data-driven services are offered without customer integration	Data-driven services are offered with little customer integration	Data-driven services are offered with customer integration	Data-driven services are fully integrated with the customer
Level of product data usage	Data is not used	0-20% of collected data is used	20-50% of collected data is used	More than 50% of collected data is used
Share of revenue	Data-driven services account for an initial share of revenue (<2.5%)	Data-driven services account for a moderate share of revenue (2.5-7.5%)	Data-driven services account for a significant share of revenue (7.5-10%)	Data-driven services play an important role in revenue (>10%)

Current readiness

The results of the survey identified some interesting insights into the types of practices that have currently been adopted.

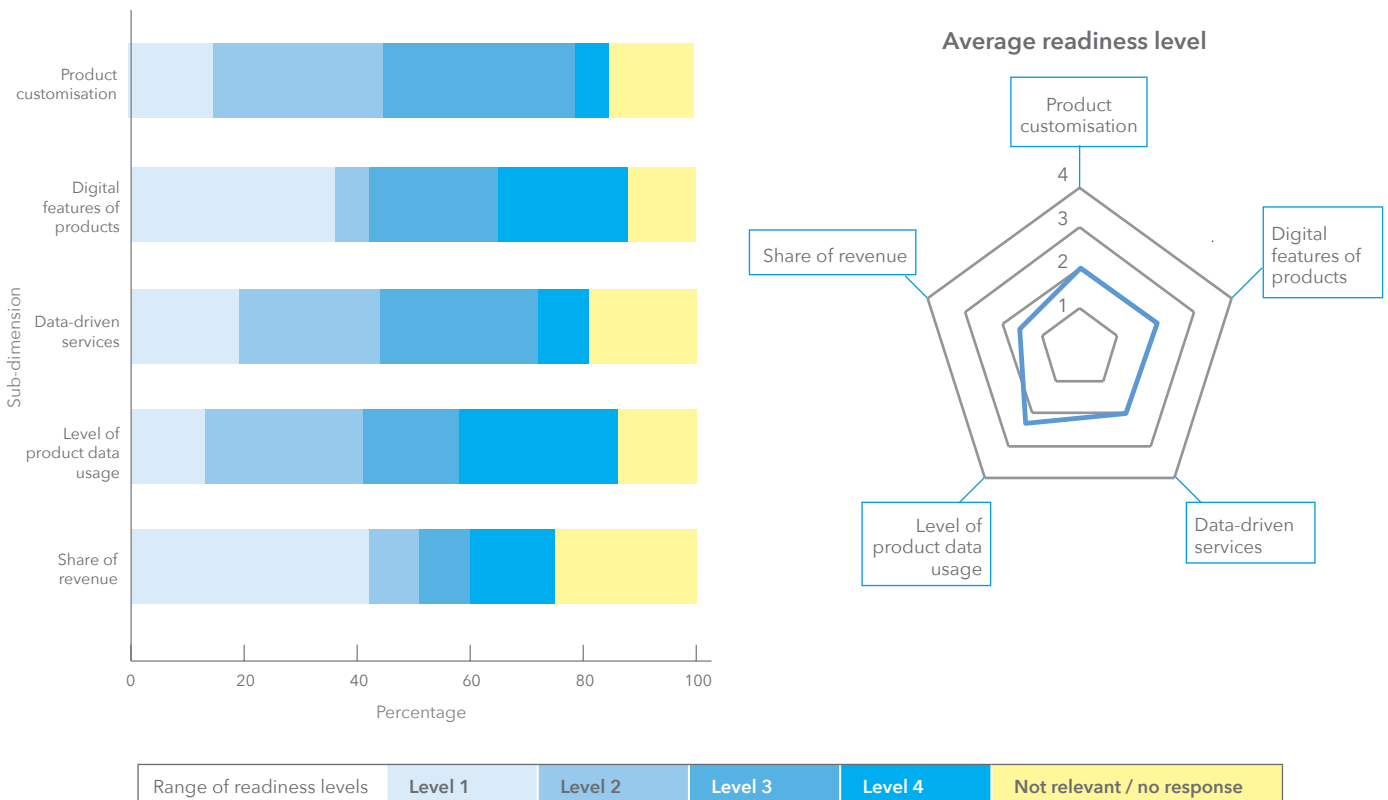
In terms of **product customisation** 15% of companies only produced standardised products, and only 6% had late product differentiation as the norm. The majority of businesses had a standard base to their products from which a limited form of customisation was available.

There was a distinct variation in the range of **digital features in products** that were offered. 28% of companies were at the highest level of maturity, offering products with a high degree of digital features and revenue from Intellectual Property (IP) licensing. However, at the other end of the spectrum, 36% of companies offered products with only a physical value.

Only 9% of companies offered **data driven services** that were fully integrated with the customer. 19% offered services with no integration, with the vast majority offering some limited degree of customer integration.

The **level of data usage** had the highest overall average. Only 13% companies used no data. 17% of companies were using more that 20% of the data they collected, and 28% more than 50%, to inform the delivery and development of value added services.

Despite the relatively promising uptake of digital features in products, the **share of revenue** from data driven services is still low. It had the overall lowest average. In 42% of companies revenue from data driven services accounts for less than 2.5% of revenue. In only 15% of companies did it account for more than 10% of revenue.



Improving readiness

There are two potential strategies that could be adopted to ensure that the products and services offered by a business are harnessing the full potential of the cyber-physical age. One strategy, is to develop physical products that are customised through the data driven services that they can support. This is the type of approach that HP and the smartphone manufacturers have adopted. The initial sale of the product creates a degree of lock in. This can be through a one-off purchase or longer term contract basis (e.g. smartphones are bought under contract over 12 months). This provides a base from which to grow the revenues from the data driven services.

The alternative route is to develop more physically customisable products. This strategy may require not only a redesign of the product, but also the technology to produce it to enable full customisation at mass-customised prices. It requires a more fundamental rethink in the way that we design and manufacture products.

These two strategies are not mutually exclusive, and the ultimate way to harness maximum potential may be to achieve a combination of the two.

Manufacturing and operations

Industry 4: potential of technology yet to be harnessed

The factory and its operation is at the heart of the vision of Industry 4. It's a vision of fully customised products, being autonomously produced in self-optimising factories. It's an environment where the cyber and the physical are one. An IoT enabled environment that allows the collection of data, that can be used to plan, optimise and control the physical operation. Where optimisation is enabled through digital modelling using real data. This is an ambitious and far reaching vision. It has the potential to revolutionise manufacturing, and should be a serious consideration for all manufacturing companies.

Sub-dimensions

Given the origins of the concept of Industry 4 in German manufacturing strategy it is not surprising that this is the dimension with the greatest number of sub-dimensions. The sub-dimensions can be loosely categorised into 5 key areas:

- ▶ **Technology integration:** Automation, machine and operations system integration (M2M)
- ▶ **Autonomous workplace:** Self-optimising processes, autonomously guided workpieces
- ▶ **Data:** Operations data collection, operations data usage, cloud solution usage, IT and data security
- ▶ **Resource capability:** Digital modelling, equipment readiness for Industry 4

Readiness level	Level 1 Beginner	Level 2 Intermediate	Level 3 Experienced	Level 4 Expert
Automation	Few machines can be controlled through automation	Some machines and system infrastructures can be controlled through automation	Most machines and system infrastructures can be controlled through automation	Machines and systems can be controlled completely through automation
Machine and operation system integration (M2M)	Machines and systems have no M2M capability	Machines and systems are to some extent interoperable	Machines and systems are partially integrated	Machines and systems are fully integrated
Equipment readiness for Industry 4	Significant overhaul required to meet Industry 4 model	Some machines and systems can be upgraded	Machines already meet some of the requirements and can be upgraded where required	Machines and systems already meet all future requirements
Autonomously guided workpieces	Autonomously guided workpieces are not in use	Autonomously guided workpieces are not in use, but there are pilots underway	Autonomously guided workpieces used in selected areas	Autonomously guided workpieces are widely adopted
Self-optimising processes	Self-optimisation processes are not in use	Self-optimising processes are not in use, but there are pilots in more advanced areas of the business	Self-optimising processes are used in selected areas	Self-optimising processes are widely used
Digital modelling	No digital modelling	Some processes use digital modelling	Most processes use digital modelling	Complete digital modelling used for all relevant processes
Operations data collection	Data is collected manually when required, e.g. sampling for quality control	Required data is collected digitally in certain areas	Comprehensive digital data collection in multiple areas	Comprehensive automated digital data collection across the entire process
Operations data usage	Data is only used for quality and regulatory purposes	Some data is used to control processes	Some data is used to control and optimise processes, e.g. predictive maintenance	All data is used not only to optimise processes, but also for decision making
Cloud solution usage	Cloud solutions not in use	Initial solutions planned for cloud-based software, data storage and data analysis	Pilot solutions implemented in some areas of the business	Multiple solutions implemented across the business
IT and data security	IT security solutions are planned	IT security solutions have been partially implemented	Comprehensive IT security solutions have been implemented with plans developed to close any gaps	IT security solutions have been implemented for all relevant areas and are reviewed frequently to ensure compliance

Current readiness

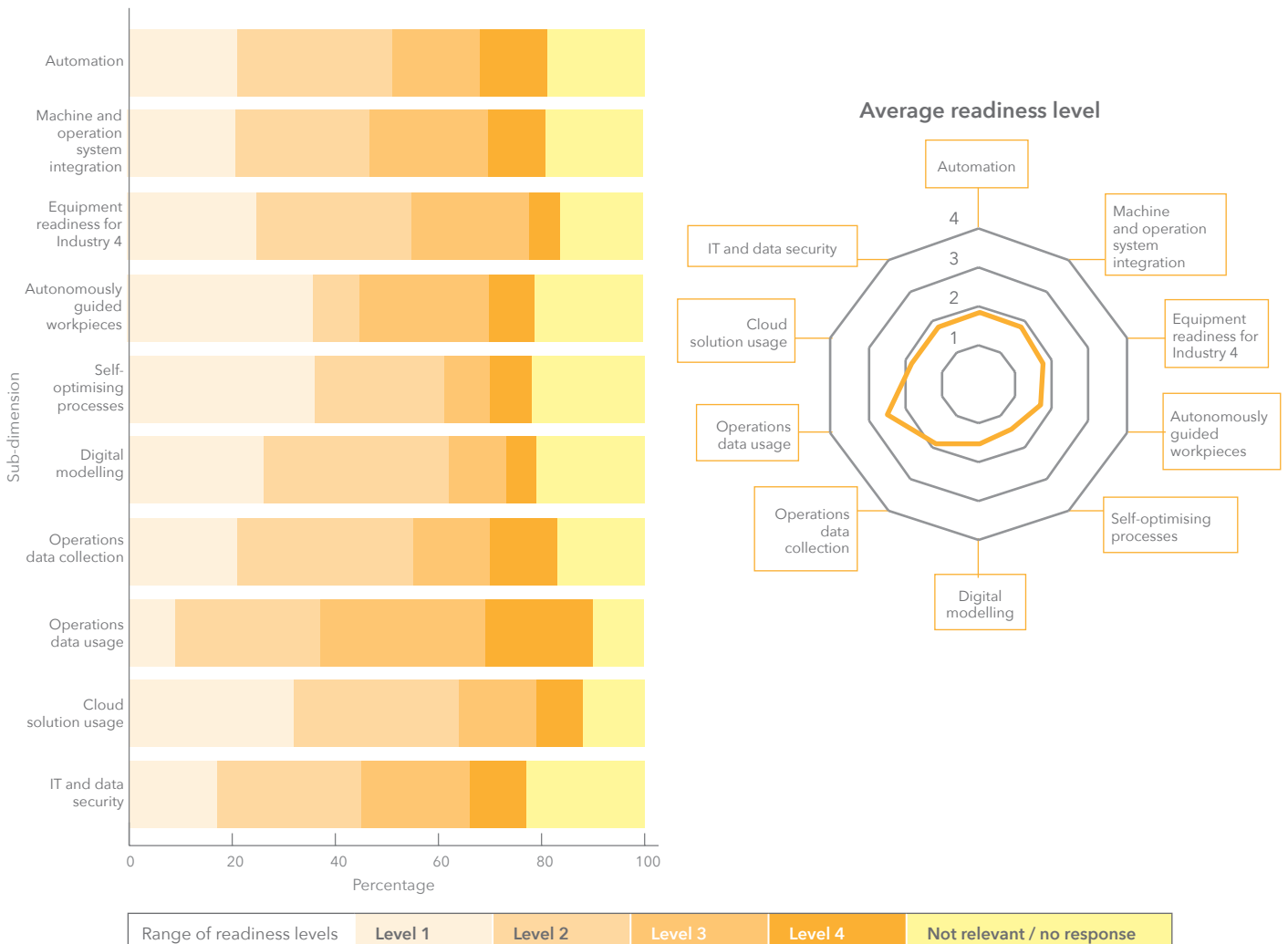
The overall results of the survey indicated that this was the second lowest level of readiness. On the one hand, it is surprising given that this represents the core of the initial Industry 4 concept. On the other, perhaps part of the challenge is the broad range of opportunities and knowing where to start.

The survey results suggest that data has been a common starting point. Whilst companies may not be leveraging the full range of **operations data collection** opportunities (average level 1.87), they are more effective at using the data they collect. This is reflected in **operations data usage** having the highest average readiness level (2.45) within the manufacturing and operations dimension. However, the potential of cloud storage usage and ensuring integrity through **IT and data security**, are areas for potential improvement.

The survey also suggests that the autonomous workplace is a vision that has yet to be turned into reality. **Self-optimising processes** were the lowest overall scoring sub-dimension, with only 8% of companies using them widely. The current adoption of **autonomously guided workpieces** was also very low, with widespread adoption in only 9% of companies surveyed.

Resource capability is another area that has potential for development. Only 6% of companies are using a **digital modelling** capability for their full range of processes. Furthermore, only 6% of companies believe that their **equipment is ready for Industry 4**, with 25% indicating that significant overhaul of current assets is required.

Some progress has been made with technology integration. 21% of companies had machines that could not be controlled through **automation** and no **machine and operation system integration**. More encouragingly, 30% of companies had the potential for the majority of their machines to be controlled through automation. 33% of companies had either partial or full machine and system integration.



Improving readiness

Given the breadth of this dimension it is difficult to know where to begin. As a starting point, it is useful to understand the general equipment readiness for Industry 4. This will include an assessment of the degree to which current equipment could be controlled through automation, and integrated into the broader operating system. This may help to identify opportunities where data could be collected and used to improve the optimisation of current processes. To ensure this is done in a secure way, it is essential to fully consider the IT and data security implications from the start.

For some the fully autonomous workplace may be a distant vision, but it is good to have a view of what that vision could be and the potential benefits. As technology becomes cheaper that vision may be closer to reality than it seems.

Strategy and organisation

Industry 4: impossible without strategic and organisational alignment

Raising the topic of Industry 4 immediately prompts many questions from business leaders: “What does Industry 4 really mean to our business? How will it impact our business strategy? What are the short-term investment requirements and opportunities for my business?”. Some also ask whether the term is simply hype. These mixed reactions show a digitalisation concept is recognised by industrial leaders, but that they are some way from embedding it into the business strategy and culture.

Industry 4 moves us into a world where computers and machines talk to each other, share data, and based on this information, change what they are going to do to make production more efficient and better meet the company's objectives. This will lead to a major cultural change, with the nature of current jobs, decisions being made, and data being available and reviewed all evolving considerably.

Sub-dimensions

The strategy and organisation section covers seven sub-dimensions assessing the implementation of Industry 4 with required ways of working, measurements, and investment in business functions and capabilities.

The topic inevitably occupies a leading position on the agenda of directors and senior executives, as it will fundamentally transform the way businesses work. It is critical that leadership teams understand the potential benefits to be realised and are developing plans to invest. However, successful implementation of Industry 4 requires far more than the senior leadership team paying lip-service to it by purchasing new technology. It also requires cross-functional support by the adoption of relevant measurements and collaborative ways of working, at both strategic and operational level. Departments will need to be open to cross-company collaboration to drive improvements.

Businesses will need employees with the right digital knowledge and capabilities to convert the strategy into actions, and investment in capabilities must be part of the agenda. It is clear that businesses are expecting to see the benefits of Industry 4, therefore it is important to ensure appropriate measurements are in place to track the return on investment as well as the effectiveness of the transformation.

Businesses have to embed the concept of Industry 4 across business functions and levels, ensuring that internal KPIs and the cross functional collaborations are consistent to drive better adoption and financial returns.

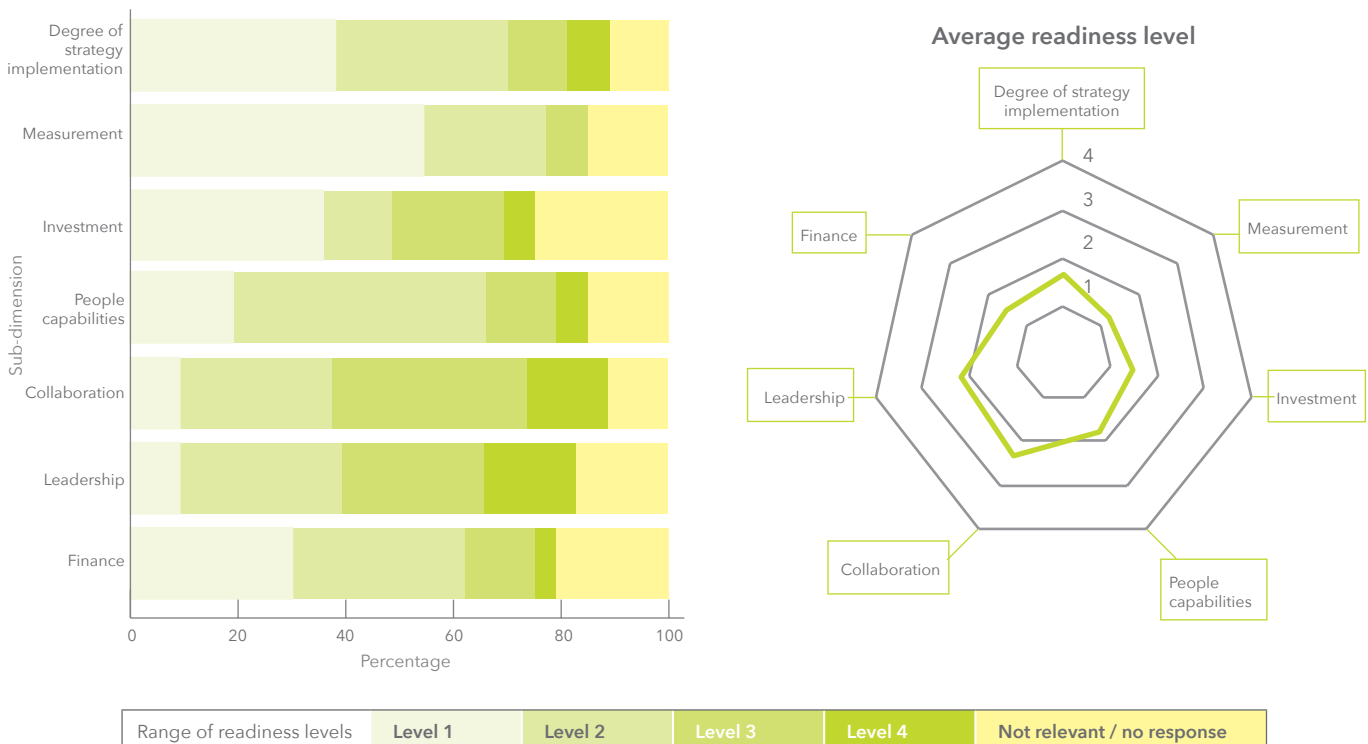
Readiness level	Level 1 Beginner	Level 2 Intermediate	Level 3 Experienced	Level 4 Expert
Degree of strategy implementation	Industry 4 is recognised at departmental level but is not integrated into the strategy	Industry 4 is included in the business strategy	Industry 4 strategy has been communicated to the business and is widely understood	Industry 4 strategy has been implemented across the business
Measurement	KPIs are not focused around Industry 4	Structured set of business metrics exist, with some measurement of Industry 4 drivers	Industry 4 metrics are widely understood in the business and used in monthly reporting	Business metrics and personal development plans are focused around Industry 4 objectives
Investments	Initial Industry 4 investments in one business area	Industry 4 investments in more advanced business areas	Industry 4 investments in multiple business areas	Industry 4 investments across the entire business
People capabilities	Employees have little or no experience with digital technologies	Technology focused areas of the business have employees with some digital skills	Developed digital and data analysis skills across most areas of the business, e.g. production	Leading edge digital and analytics skills across the business
Collaboration	The business operates in functional silos	There is limited interaction between departments, e.g. S&OP process	Departments are open to cross functional collaboration	Departments are open to cross company collaboration to drive improvements
Leadership	Leadership team do not recognise the value of Industry 4 investments	Leadership team are investigating potential Industry 4 benefits	Leadership team recognise the financial benefits to be obtained through Industry 4 and are developing plans to invest	Widespread support for Industry 4 within both the leadership team and across the wider business
Finance	No sizeable Industry 4 investment	No ongoing review of cost/benefit analysis for Industry 4 investment	Annual cost/benefit analysis of Industry 4 investment	Quarterly cost/benefit analysis of Industry 4 investment

Current readiness

For Industry 4 to be sustainable, it must be embedded into the business strategy and founded on a strong base of digital culture and skills. When measured, the Strategy and Organisation segment has the lowest maturity level of all areas in the survey:

- ▶ Leadership recognises the benefits of Industry 4, but it is a long way from turning it into a way of life
- ▶ Companies and functions that depend on technology are the most advanced, but overall a lack of digital culture and skills exists even across these organisations
- ▶ Limited business measures are in place to reflect the true total cost of ownership vs. business benefits
- ▶ Personal performance measurements aren't driving Industry 4 adoption

So, leadership claims to recognise the benefits, and is planning to invest. In technological areas this is happening, but overall evidence suggests actions are not speaking louder than words, and calls into question the real level of commitment to Industry 4. There is limited measurement of returns (despite being prepared to invest large sums); personal indicators do not drive inter-departmental collaboration, (even though integrated working is key to any company achieving its overall strategic goals), and despite the new skills and approach required, there are few structured training programmes for existing staff.



Improving readiness

A successful transformation of Industry 4 will bring tangible financial benefits by reducing operating costs and improving business efficiency, as well as other less quantifiable benefits such as being recognised as a brand that is innovative and market leading.

Implementation is major change project, and is not something that can be concentrated on for a couple of years, and then assumed to be "done". It must become the bedrock of how the company works, and how its processes are structured.

It will require a strong commitment to invest, not just in the technology and IT equipment, but more importantly in process, people and culture. While digital technologies are rapidly becoming a commodity, success largely depends on an organisation's digital capability and skills, and its leaders' commitment to define, lead, and communicate the transformation.

To conclude, the transformation of Industry 4 takes time and concentration. To be successful it is critical for the industry leaders to:

- ▶ Drive cultural change. It is about using increasingly intelligent processes and the freedom to make decisions to **accelerate business strategy and organisation goals**
- ▶ Understand **the readiness** from the strategy and organisation perspective for a revolutionary change. The **maturity levels** are differentiated by the depth and breadth of interactions across business functions
- ▶ Align **functional and department goals** and strategies with **business strategy**. Leaders need actively to support the change, and individual and organisational measurements need to drive the right behaviours
- ▶ Ensure the right **capabilities and equipment** are invested in, and sustained through constant training, process monitoring and technological enhancement

Supply chain

Supply chain integration: the secret success factor of Industry 4

If the vision of Industry 4 is to be realised, most business processes and systems must become fully digitalised. Many industry leading companies have taken the step to implement advanced technology across their supply chains to improve visibility and bring down the walls between different business functions.

However, research shows that one of the biggest challenges in Industry 4 implementation does not lie in how companies apply individual technologies or make improvements in single business functions, but in how effective they are at developing an integrated supply chain approach that connects with suppliers and customers. This is the only way to fully exploit the potential that Industry 4 offers.

Achieving full digital collaboration and then using it effectively throughout the supply chain requires all companies involved to develop processes, capabilities and systems to support them. Culturally they must develop the responsibility and trust to openly share accurate information in a timely manner and with many outside their own organisational boundaries. For many companies, this requires a maturity far beyond that exhibited in their traditional supplier and customer relationships.

Sub-dimensions

Industry 4 not only involves the digitalisation of horizontal and vertical value chains, but will also revolutionise the product and service portfolio of companies, with the goal of better satisfying customer needs in a cost-effective method. To ensure that customers will benefit from better services and flexibility, businesses will need to be capable of immediately responding to changes in market environment and individual customer requirements. Traditionally, better supply chain agility could mean shorter lead time and more flexibility in service, but it could also mean more inventory and higher end to end supply chain costs.

The implementation of Industry 4 can make a revolutionary change to that traditional approach, by giving better visibility of upcoming demand and inventories throughout the supply chain. Having real-time information about site location, capacity, inventory and operations throughout supply chain enables better response to customers' needs. This information sharing enables supply chain integration, so facilitating a more agile response from upstream suppliers to downstream logistics providers, driving efficiencies and improved service throughout the supply chain.

Readiness level	Level 1 Beginner	Level 2 Intermediate	Level 3 Experienced	Level 4 Expert
Inventory control using real-time data management	Inventory levels are understood	Computer database is used which is manually updated with inventory levels	Computer database used with smart devices updating inventory levels	Real-time database which is updated by smart devices
Supply chain integration	Ad hoc reactive communication with suppliers and customers	Basic communication and data sharing where required with suppliers and customers	Data transfer between key strategic suppliers/ customers (e.g. customer inventory levels)	Fully integrated systems with suppliers/customers for appropriate processes (e.g. real-time integrated planning)
Supply chain visibility	No integration with suppliers or customers	Site location, capacity, inventory and operations are visible between first tier suppliers and customers	Site location, capacity, inventory and operations are visible throughout supply chain	Site location, capacity, inventory and operations are visible in real-time throughout supply chain and used for monitoring and optimisation
Supply chain flexibility	Slow response to market changes	Moderate response to market changes and general customer requirements shifts	Moderate response to changes in market environment and individual customer requirements	Immediate response to changes in market environment and individual customer requirements
Lead times	Long materials lead time resulting in high inventory levels	Improvements have been identified to reduce lead times for some materials	Some improvements have been implemented to reduce lead times on key materials	Differentiated stocking policies and lead times to meet make-to-order efficiently

Current readiness

Those responding to the survey say that their companies are focusing most on using real-time data to manage and improve their overall business planning and manufacturing operations, followed closely by efforts to improve supply chain agility to react to changes in the market environment and individual customer requirements. But these approaches are just the beginning. Real-time, high quality information is being used predominantly to drive segmented business decisions, with very limited sharing and integration with suppliers and customers.

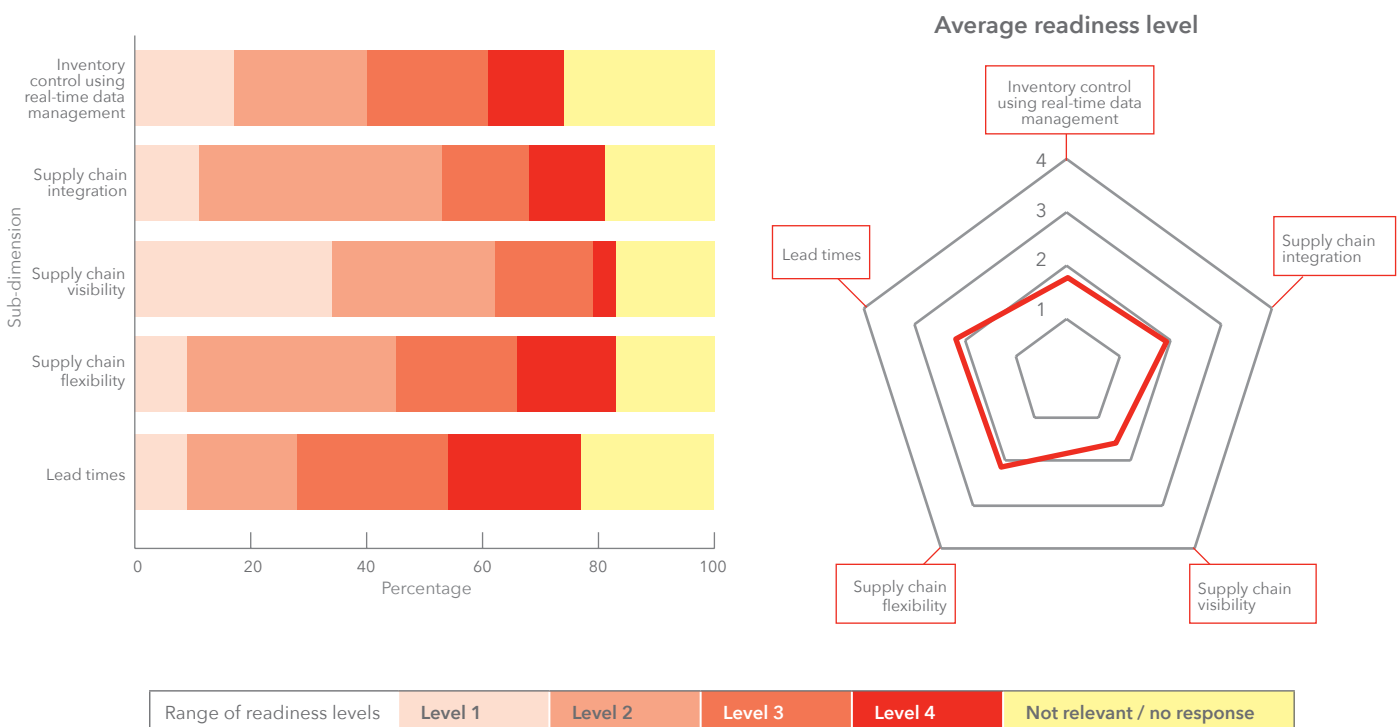
Data lies at the heart of Industry 4, but the massively growing information flow brings little value unless it is accurate (“garbage in, garbage out” becomes even more relevant as the quantity and reliance on systems to drive decision making grows); timely (both provided on time, and even if it comes from different sources, covering the same period); and is deployed intelligently (those who need to know are informed, but different elements of the supply chain are not swamped with a meaningless volume of data, that obscures what really matters).

Greater integration of data throughout the supply chain brings new collaboration opportunities. Sharing and using information intelligently allows suppliers to help manufacturers in production and inventory planning, driving efficiencies in both the manufacturer’s and customer’s operations. Many companies claim to have such collaborative opportunities in sight, but over 30% of companies in our survey claimed no integration with suppliers or customers. Maybe this 30% are more honest than the remaining 70%, not necessarily in terms of whether they are trying to collaborate, but in terms of how effective they are at it.

This is because, as highlighted in the survey, many respondents say their companies have ad-hoc basic communications with suppliers and customers, most of the time when there is a risk to service, followed by short term mitigation actions which potentially have an impact on other parts of the supply chain.

There are other benefits of supply chain integration that far fewer companies have on their radar. These include better service and maintenance of companies’ assets and products held by suppliers, and better cooperation and decision-making with customers. These open possibilities for new service offerings and ways of working, and business leaders need to get there ahead of competitors. To succeed, companies will need to share and use information in a forward-looking way that integrates the supply chain.

These ad-hoc approaches to supply chain integration or visibility are part of what is inhibiting companies’ journeys to Industry 4 implementation.



Improving readiness

The absence of a digital culture and capabilities were identified as a top challenge in Industry 4 implementation. The secret success factor of Industry 4 is to embed the concept of supply chain integration into the hearts and minds of the organisation, and all those up and down the supply chain; moving beyond ad-hoc approaches and distrust. This requires an aligned understanding of the capability levels, business process gaps, and systems both internally and across suppliers and customers, and adopting a culture in all elements of the relationship to promote an effective collaborative approach.

The secret success factor of Industry 4 lies in an integrated supply chain approach connecting parties throughout the supply chain. To be successful, it is critical for industry leaders to:

- ▶ Develop an **integrated supply chain** approach, allowing intelligent information sharing and communication with suppliers and customers, to drive agility and efficiency
- ▶ Demonstrate to all participants that the **benefits of integration** will be shared, and the knowledge gained not used adversely against the weaker players in the supply chain
- ▶ Identify and gather **real-time information** using advanced technologies, deploying it for the right purposes and effectively analysing it to make the right decisions
- ▶ Embed a **culture of integration** within the business and all those involved in the supply chain

Business model

Industry 4: an opportunity for business model innovation

Whilst its roots may be in the domain of the factory, the most significant opportunity that Industry 4 presents is to redefine the way we do business. It provides the opportunity for businesses to evolve their current business model. For instance, the way in which catalogue based retailers have capitalised on the opportunity to move their businesses online. Equally, it can be more revolutionary in nature. The advent of ‘market mediators’ (platforms that provide visibility and matching of demand and supply) are disrupting traditional markets. Prominent examples include Airbnb, ebay, Uber and Whim.

It is critical for businesses to ensure that their business model is contemporary and regularly refreshed. It is equally important to consider the opportunities that Industry 4 presents in terms of developing a company's own business model as well as the potential threat of new disruptive entrants.

Sub-dimensions

The blurring of the lines between products and services has implications for business model design, and has seen a proliferation of **‘as a service’ business models**. The UK has seen a shift from outright car ownership (a product), to a service. A monthly payment secures dedicated access to a car, for a set number of miles per year with agreed maintenance and breakdown recovery. The next stage in the evolution is the view of ‘mobility as a service’ which questions the need for dedicated access to a car. Such provisions can be dependent on the **real-time tracking** of the product, and the **real-time and automated scheduling** of maintenance activities. For instance, protecting the residual value of a car on a monthly service plan, requires the appropriate maintenance regime. It could be further enhanced if **data driven decisions** could be taken on which maintenance activities to carry out. Such business models breakdown the traditional view of routes to market and customer touchpoints, and require more **integrated marketing channels**. **IT supported business**, where IT systems support and integrate all company processes will be fundamental to harnessing the potential of Industry 4.

Readiness level	Level 1 Beginner	Level 2 Intermediate	Level 3 Experienced	Level 4 Expert
‘As a service’ business model	No awareness	Aware of concept with some initial plans for development	High awareness and implementation plans are in development	‘As a service’ has been implemented and is being offered to the customer
Data driven decisions	Data is not widely analysed	Some data is analysed and features in key business reports to review performance	Most data is analysed and the result is considered when making business decisions	All relevant data is analysed and informs business decisions
Real-time tracking	Limited product tracking	Product can be tracked as it moves between manufacturing and internal distribution sites	Product can be tracked through manufacturing and distribution until it reaches the customers distribution centre	Product can be tracked along the complete lifecycle
Real-time and automated scheduling	Equipment is manually maintained in line with the maintenance schedule	Some machines alert operators of a performance issue which enables them to manually schedule a maintenance task	Some machines are self-diagnosing, automatically passing information to the maintenance scheduling system	Machines are generally self-diagnosing and the maintenance schedule adjusts itself based on real time data inputs from the machine
Integrated marketing channels	Online presence is separated from offline channels	Integration within the online and offline channels but not between them	Integrated channels and individualised customer approach	Integrated customer experience management across all channels
IT supported business	Main business process supported by IT systems	Some areas of the business are supported by IT systems and integrated	Complete IT support of processes but not fully integrated	IT systems support all company processes and are integrated

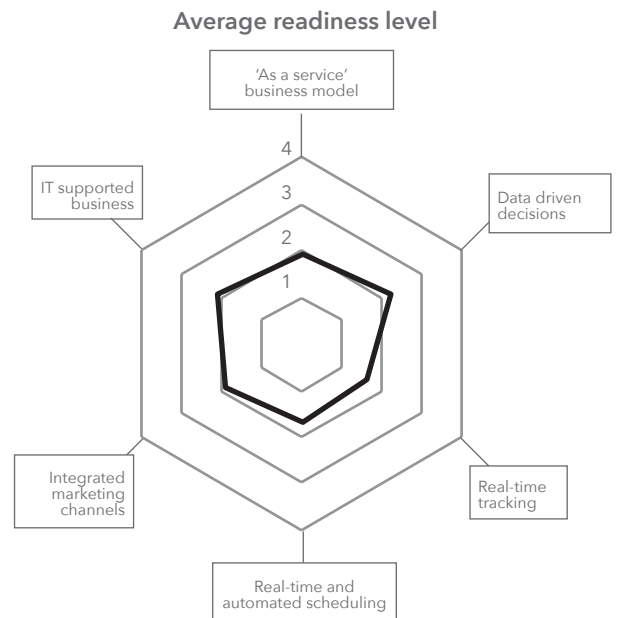
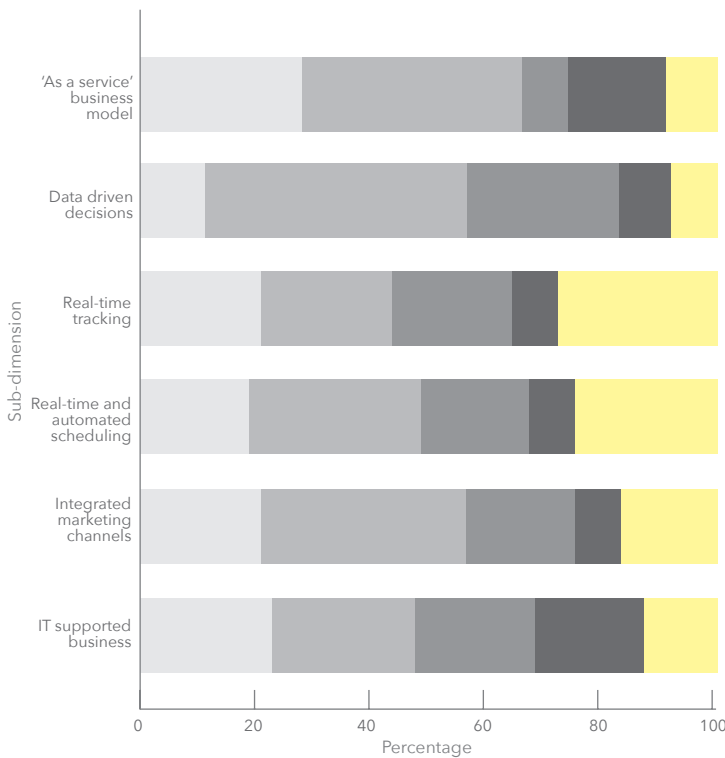
Current readiness

Business model readiness ranked 4th across the 6 dimensions for overall readiness for Industry 4. **IT supported business** is a critical enabler to the development of new business models. 40% of companies reported full IT support for their processes, with 19% achieving full integration. This is important as such a full and integrated IT backbone is essential for **data driven decisions**. This was the highest ranking sub-dimension. Whilst only 9% are using all relevant data to inform business decisions, 21% are using most data and a further 25% some data.

The sub-dimensions with lowest readiness related to the **real-time tracking** of products, and **real-time and automated scheduling**. Surprisingly, for both sub-dimensions over 25% of companies did not see the relevance to their business. Only 8% of companies were able to track the product across the complete lifecycle or automatically diagnose and schedule maintenance. 19% of companies had limited product tracking, and 21% independent manual maintenance schedules.

Integrated marketing channels and customer touch points remains an area for improvement, with only 8% of companies having fully integrated customer experience management across all channels. The majority (36%) had integration within their offline and online channels, but not between them.

'As a service' business models are in their infancy. 17% of companies had implemented this offering, although the majority (45%) were aware of the concept and had some initial plans for development, whilst 34% had no awareness.



Improving readiness

A two-prong approach to improving the readiness of the business model dimension is suggested. The first-prong focuses on the improvement of the current business model. Companies can continue to invest and leverage the IT support that is required to support and integrate current processes. This provides a strong platform from which the business start to utilise data to make more evidence based business decisions. This could also help to deliver a more integrated customer experience across all channels, removing the divide between offline and online.

In parallel companies need to look to the future and consider alternative business models (e.g. 'as a service') and what this could mean to their business. This could drive (where appropriate) the business case for investment in technology to enable more real-time tracking and scheduling.

Legal considerations

Industry 4: early consideration of legal aspects critical to success

Industry 4 is far reaching in its scope with the potential for both evolutionary and revolutionary change to manufacturing operations, supply chains and business models. It has long been recognised (though perhaps not always adopted) that the early involvement of manufacturing and supply chain in the new product development process is essential for successful commercialisation of new products. For companies to successfully evolve their business practice to harness the full potential of Industry 4, much earlier consideration of the legal aspects will also be required. Early identification of the legal issues such a transformation presents, will promote innovation within the legal profession to find effective ways to handle these issues.

Sub-dimensions

Four legal dimensions for assessment were identified: contracting models, legal risk, data and intellectual property. These dimensions pose the areas of greatest legal risk but also of greatest opportunity when handled in the most effective way. These are areas on which companies are beginning to focus their attention.

As a result of the adoption of Industry 4 contracting models are being challenged, particularly the traditional linear models. However, there is a need for both cultural and legal change to move to more collaborative arrangements, often between more than two parties, with openness to the sharing of both risk and reward.

In the area of legal risk there are multiple risks to be considered. The readiness assessment focuses on the overarching consideration of legal risk and considers both the key measure of risk awareness and the actions required to address such risks.

The generation and flow of data is a fundamental element of Industry 4 and an enabler for the creation of value. However, the appropriate protection and use of data (both proprietary and third party owned) is essential both to the functioning of Industry 4 and to the realisation of the value of the data.

The identification, protection and exploitation of intellectual property has always been of utmost importance to companies to distinguish their products and services from those of competitors. The adoption of Industry 4 brings these issues in to sharp focus and expands the range of rights to be considered, in particular the interaction with third party intellectual property rights.

Readiness level	Level 1 Beginner	Level 2 Intermediate	Level 3 Experienced	Level 4 Expert
Contracting models	Contracting processes are linear and unchanged	Some changes to contracting processes to reflect operational changes	Some 'flagship' projects utilise new contracting models but it is not standard across the board	All contracting is behavioural and incentivises all parties to achieve the best result
Risk	New risks not identified or assessed	New risks identified and/or assessed but no mitigations planned	New risks identified and assessed, and limited mitigations put in place	Working party has assessed the changing risk profile and has procedures in place to mitigate these
Data protection	No data protection policies or procedures	Have internal policies but do not ensure compliance in engagement with suppliers/customers	Good understanding with robust policies and procedures but haven't updated for General Data Protection Regulation	Conducted a recent General Data Protection Regulation audit and are confident of compliance including in light of Industry 4
Intellectual property	Intellectual property in new products and services is not identified or protected	Awareness of intellectual property in new products and services, but no legal protections identified or applied for	Intellectual property in products and services is identified and in part assessments made as to whether registrations/contractual rights required, and if required, appropriate steps taken	Intellectual property in products and services is identified and assessments made as to whether registrations/contractual rights required and, if required, appropriate steps taken

Current readiness

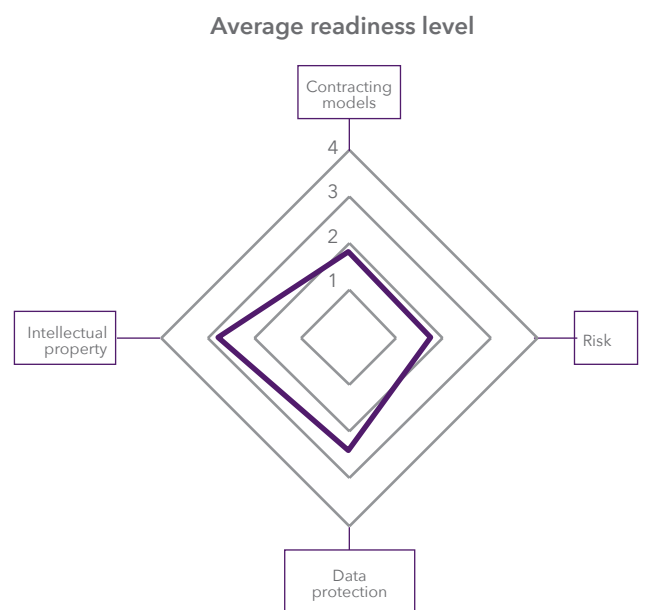
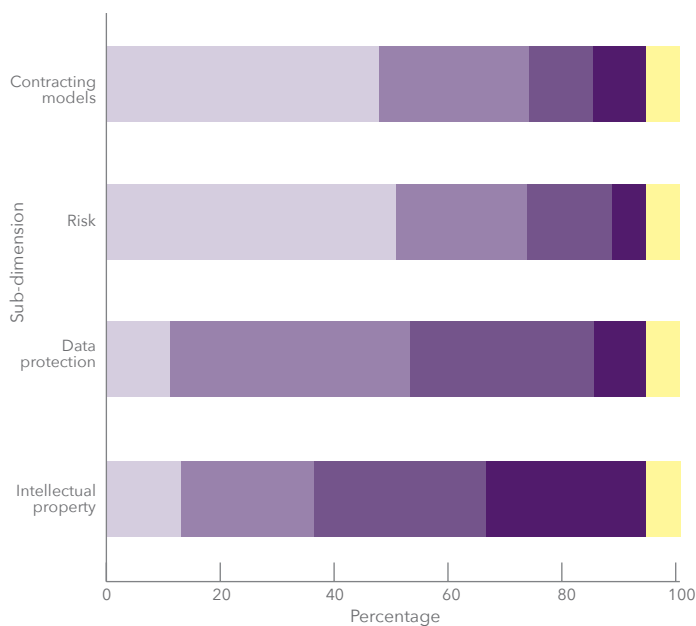
The results of the survey demonstrated noticeably different results in relation to each legal dimension.

Contracting models - 50% of respondents indicated that their contracting behaviours remained unchanged. Whilst this may not present an immediate legal risk, it is likely to result in missed commercial opportunities. The greatest opportunities from the adoption of Industry 4 will require contracting models providing for greater collaboration and partnership models. There will be much broader scope to embrace the benefits of Industry 4 and develop more fruitful relationships within supply chains if contracting models become less linear and more flexible or collaborative.

Legal risks - Most surprisingly, 54% of respondents had not considered nor addressed legal risks. They were not aware of the nature of the “lurking” legal risks presented by Industry 4. Lack of awareness of the risks results in the maximum scope for exposure to such risks. It is also very difficult for the Board of these businesses to take informed decisions in relation to “unknown unknowns”.

Data protection - The responses to the data questions were considerably more positive. Whilst 12% had no policies or procedures in relation to the handling of data, 34% had a good understanding and robust policies and procedures for adherence. However, it is notable that only 10% had conducted an audit of their data processing activities and had confidence in their meeting the legal requirements for data use/protection compliance.

Intellectual property - The intellectual property results were even better. Only 12% of respondents had not identified or protected the intellectual property in their products and services. Encouragingly 32% had identified, assessed and taken appropriate steps to secure protection. Yet the extent of the intellectual property Industry 4 issues does not appear to be fully understood, in particular the increased need to share and secure licences of third party intellectual property.



Improving readiness

Industry 4 is the number one technology trend impacting business strategy. To benefit from the opportunities and improve the level of Industry 4 maturity the legal risks must be clearly understood at board level.

It is perhaps the publicity and perceived value around both data and intellectual property which resulted in respondents to the survey having identified and started to address these issues. However, it is clear that there is a lot more to be done to increase the breadth and depth of awareness of all of these dimensions and the legal challenges/potential pitfalls.

As well as increasing awareness of the issues, the boards need to understand the necessary investment, planning and actions required to successfully address them. In particular the effective handling of such issues should be seen as enablers and not barriers.

Businesses’ ability to understand the types of collaborative contracts which can be achieved will assist them in entering arrangements set to achieve greater gains for all involved. Anticipating the legal risks and liabilities will enable manufacturers to plan for and successfully navigate the potential difficulties. Having the confidence to handle data in a legally compliant manner will reap greater rewards. Anticipating intellectual property challenges enables businesses to reach more beneficial arrangements with third parties.

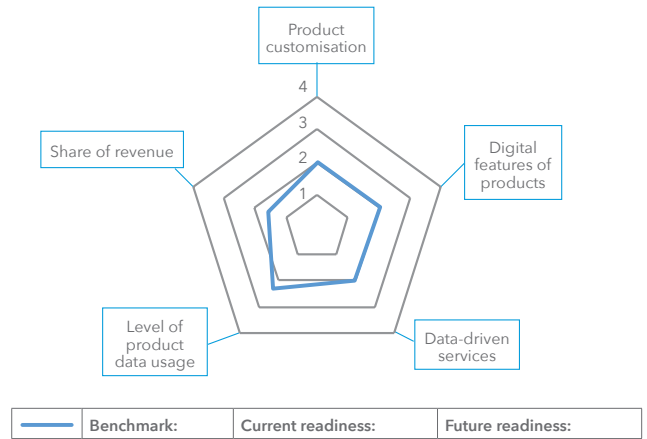
However, the responsibility does not only rest with business. The current legal environment leaves a number of the implications of these legal dimensions uncertain. For example, liability for the use of unreliable or corrupted data or for the decisions of robots is subject to great debate and some reluctance to adopt new technologies. Government, and legislators must invest in the provision of greater legal certainty around some of these difficult issues to counter the related reluctance to prepare and engage fully with Industry 4.

Industry 4 readiness self-assessment templates

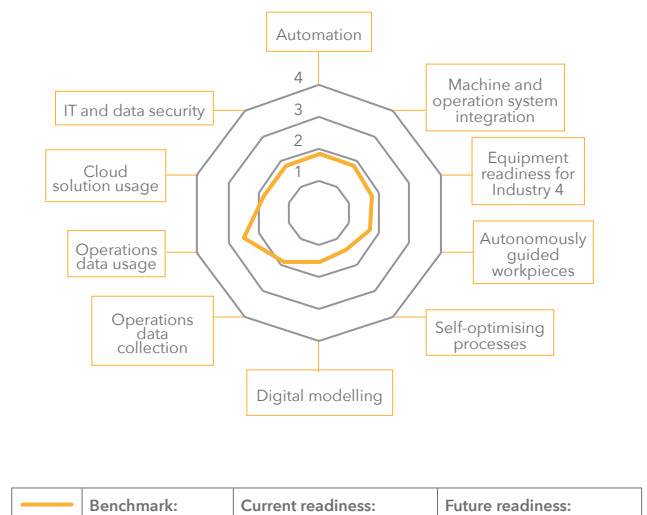
These templates will help to document and benchmark your company's current level of Industry 4 readiness. For each of the 6 dimensions, use the readiness assessment criteria to identify your current level of readiness (1,2,3 or 4) for each of the sub-dimensions. Transfer these levels to the summary tables below. If a sub-dimension is not relevant, then mark it as NR. Repeat the exercise to document your future ambition.

You can then benchmark your company results by plotting the score for your current Industry 4 readiness on the relevant spidergram and joining them together. In a different colour, repeat for future ambition to highlight the gap between current readiness and future ambition.

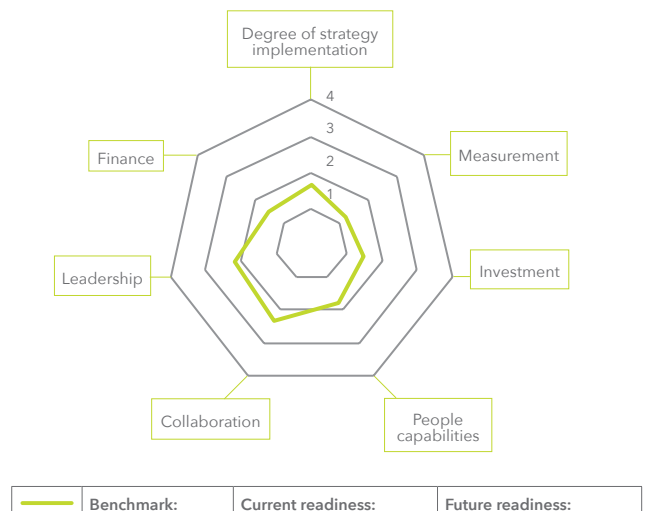
Product and services Sub-dimensions	Readiness level (1-4) or not relevant (NR)	
	Current	Ambition
Product customisation		
Digital features of products		
Data-driven services		
Level of product data usage		
Share of revenue		
Dimension total		
# applicable sub-dimensions		
Dimension average (Total / # relevant sub-dimensions)		



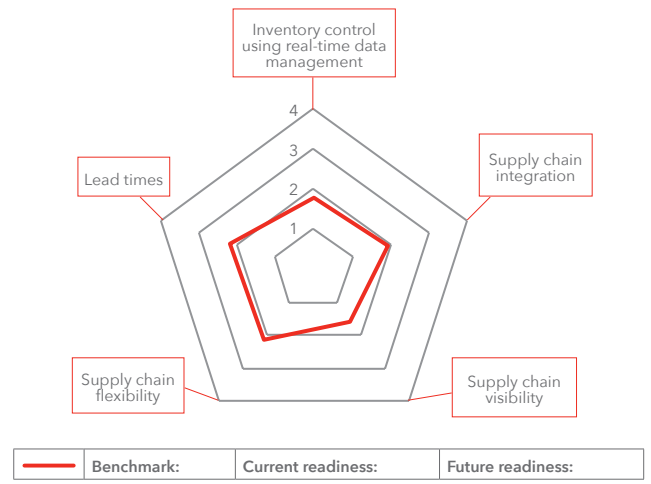
Manufacturing and operations Sub-dimensions	Readiness level (1-4) or not relevant (NR)	
	Current	Ambition
Automation		
Machine and operation system integration (M2M)		
Equipment readiness for Industry 4		
Autonomously guided workpieces		
Self-optimising processes		
Digital modelling		
Operations data collection		
Operations data usage		
Cloud solution usage		
IT and data security		
Dimension total		
# applicable sub-dimensions		
Dimension average (Total / # relevant sub-dimensions)		



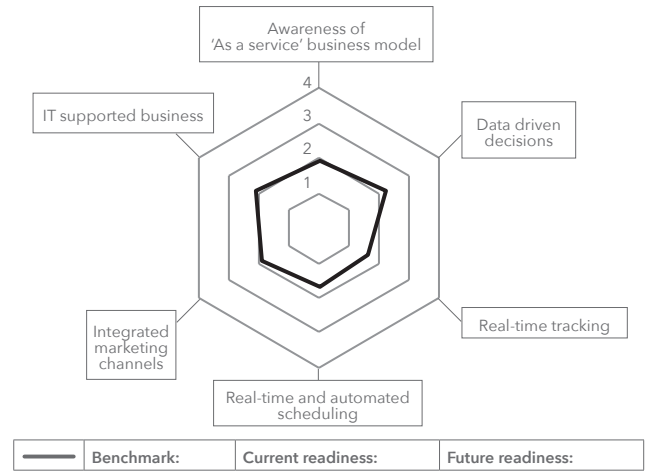
Strategy and organisation Sub-dimensions	Readiness level (1-4) or not relevant (NR)	
	Current	Ambition
Degree of strategy implementation		
Measurement		
Investments		
People capabilities		
Collaboration		
Leadership		
Finance		
Dimension total		
# applicable sub-dimensions		
Dimension average (Total / # relevant sub-dimensions)		



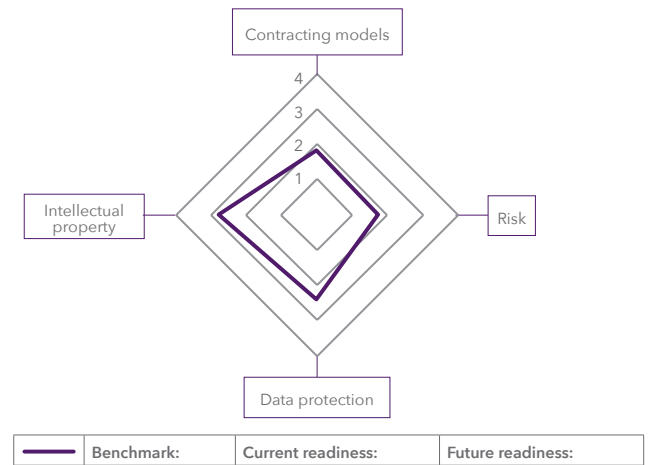
Supply chain Sub-dimensions	Readiness level (1-4) or not relevant (NR)	
	Current	Ambition
Inventory control using real-time data management		
Supply chain integration		
Supply chain visibility		
Supply chain flexibility		
Lead times		
Dimension total		
# applicable sub-dimensions		
Dimension average (Total / # relevant sub-dimensions)		



Business model Sub-dimensions	Readiness level (1-4) or not relevant (NR)	
	Current	Ambition
Awareness of 'As a service' business model		
Data driven decisions		
Real-time tracking		
Real-time and automated scheduling		
Integrated marketing channels		
IT supported business		
Dimension total		
# applicable sub-dimensions		
Dimension average (Total / # relevant sub-dimensions)		



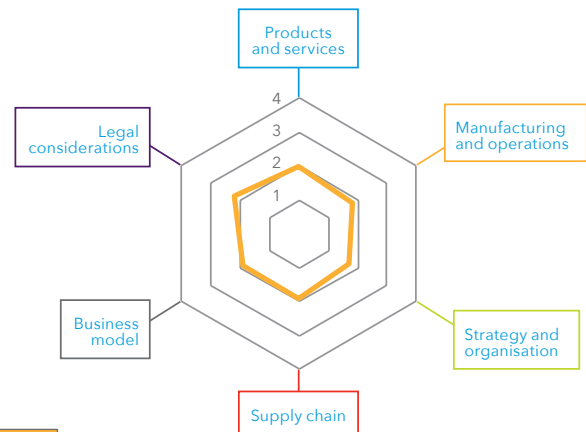
Legal considerations Sub-dimensions	Readiness level (1-4) or not relevant (NR)	
	Current	Ambition
Contracting models		
Risk		
Data protection		
Intellectual property		
Dimension total		
# applicable sub-dimensions		
Dimension average (Total / # relevant sub-dimensions)		



Overall Industry 4 readiness

Consider your company's overall Industry 4 readiness. Plot the scores for the current state dimension averages to the spidergram and join them together. In a different colour repeat for future ambition.

	Benchmark:	Current readiness:	Future readiness:
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Readiness levels	Level 1 - Beginner	Level 2 - Intermediate	Level 3 - Experienced	Level 4 - Expert
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Thank you to our authors

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The information contained in this report was correct at the time of going to print.