Technology has become a critical enabler for businesses, allowing them to extract value further on through the lifecycle.

DIGITAL TRANSFORMATION MATURITY SPECTRUM ACROSS MANUFACTURING SECTOR

% OF RESPONDENTS

- **Nascent** - 0%
  - Disconnection between business and digital IT initiatives and misalignment with company strategy

- **Exploratory** - 17%
  - Recognition of need for digital transformation strategy but execution is on ad-hoc project basis, meaning it is neither repeatable nor predictable

- **Enabled** - 53%
  - Alignment between business and IT goals but not yet focused on the disruptive potential of digital initiatives

- **Enhanced** - 25%
  - Integrated and synergistic business - IT management delivering digitally enabled product/service experiences on a continuous basis

- **Optimized** - 4%
  - Digital transformation is a primary strategic focus at executive level and the company is unrelentingly disruptive in the use of new digital technologies and business models
LEADING THE WAY

As an early adopter of technology, the manufacturing sector is now taking full advantage of the range of digital technologies available.

Digital transformation in manufacturing cannot be regarded as a single entity. Rather, it should be considered a combination of different technologies, including big data, cloud, Internet of Things (IoT), artificial intelligence (AI), augmented reality, and 3D printing.

The use of these technologies has grown beyond their application in the manufacturing process alone. As the sector is moving away from a product-selling model toward a service-led model, the technology it needs, and how it is using that technology, is changing and becoming more diverse. For example, a firm might be using cloud software or cloud options to help improve the efficiency of its maintenance schedules, or using IoT to get information fed back from products that are out in the field.

Technology has become a critical enabler for businesses, allowing them to extract value further on through the lifecycle, not just via production-process cost control.

The manufacturing industry has traditionally kept up with technological advances more closely than other industries, often being more readily adaptable and accepting of the new technologies. This is in part due to the commoditization of standardized products, which has squeezed margins, forcing firms to leverage technology to create cost efficiencies. A good example of such early adoption can be seen with robotics, a long-established technology used in manufacturing. In some cases, the application of robotics in the production process has reduced the workforce by 90 per cent. As the technology has become more advanced, manufacturers have continued to evolve their capabilities, having a positive effect on their business.

A MATURE MARKET

Our research reflects this high-touch relationship that manufacturing has in its adoption of technology. Overall, firms are sanguine in their assessment of DT maturity, with 95 per cent of respondents identifying themselves as ‘enabled’, ‘exploratory’ or ‘enhanced’; not a single firm was still in the ‘nascent’ stages. North America was at the forefront of manufacturing digital change, with 55 per cent of North American respondents identifying as ‘enhanced’ or ‘optimized’ – far higher than the 29 per cent and 21 per cent exhibited in EMEA and APAC respectively. In part, that reflects the developed nature of Canada and the USA versus EMEA and APAC, which each contain a diverse set of nations at a range of developmental stages and levels of manufacturing industries.

While 84 per cent of respondents think funding for DT is either ‘adequate’ or ‘advantageous’, this was the lowest percentage of any industry. Even more unprecedented is that 12 per cent of respondents consider the funding for DT to be excessive – a response not found in any other industry. This suggests that competitive pressure is leading firms to speculate with investment – and maybe not always generating the desired result – or that they are not allocating budget effectively to get value for money.
Compressed time-to-market pressures and servitization demands are driving digital change in what is an already tech-savvy industry.

Strategically, many firms are in the process of shifting their focus away from a product itself and towards the capability that the product offers via ‘servitization’. This shift is contributing to the imperative for digital change. The servitization of the market is being driven partly by competitive pressures, but also, increasingly, by pressure from consumers who are demanding more and wanting everything faster. Conceptually, businesses must give the customer something different – usually by wrapping a product in an add-on service, which better responds to the customer’s needs.

To be successful in their response to customer needs and increasing demands, manufacturers must compress time to market, taking an idea through from design to a saleable item as quickly as possible. Digital technologies can help with this. For example, 3D printing was once only seen as a solution for improved prototyping, but as it has matured it has proven its place in the quick, efficient and cost-effective production process, facilitating speedy fulfillment, increased customization and delivery of highly complex designs.

Our results show that manufacturers see the advantages of digital change in commercial growth, with 37 per cent of manufacturers identifying ‘accelerating innovation’ as a driver for change, which is more than in any other industry. This contrasts with how DT is often perceived in other sectors, where it is considered as almost exclusively an efficiency play. In manufacturing responses, ‘accelerating innovation’ and ‘competitive differentiation’ were rated comparably with ‘internal process efficiencies’ and ‘cost savings’. In part, this reflects the highly quantified environment of manufacturing, which has already made efficiency management an integral part of the business. This has enabled what is already a tech-savvy industry to focus on early adoption and experimentation with new technologies.

**ACCELERATING INNOVATION**

North American and APAC manufacturers in particular see the growth potential, considering ‘competitive differentiation/advantage’ and ‘accelerating innovation’ respectively their number one advantage derived from digital change.

The demand for greater innovation in DT can also be seen in the industry’s appetite for collaboration. An example of this is the Advanced Manufacturing Research Centre (AMRC) in the UK where companies collaborate to solve problems and research new technologies that are of practical use to them all. It allows companies to come in and play with ideas – looking at what can be done without being asked to make financial investments.

The latest technologies, particularly IoT and cloud, offer huge opportunities, and a range of possible combinations, to the point that almost every manufacturing firm can use them to gain competitive differentiation via DT. Those that do not adopt digitalization in line with the market’s rapid pace will fall behind.

Manufacturers see the advantages of digital change in commercial growth, with 37 per cent identifying ‘accelerating innovation’ as a driver for change.

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**TOP FIVE DRIVING FACTORS FOR DT**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal process efficiencies</td>
<td>40%</td>
</tr>
<tr>
<td>Accelerating innovation</td>
<td>37%</td>
</tr>
<tr>
<td>Cost savings</td>
<td>33%</td>
</tr>
<tr>
<td>Increased differentiation/advantage</td>
<td>32%</td>
</tr>
<tr>
<td>Increased competitive pressure</td>
<td>28%</td>
</tr>
</tbody>
</table>

**#1 DRIVING FACTOR BEHIND DIGITAL CHANGE BY REGION**

<table>
<thead>
<tr>
<th>Region</th>
<th>Factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>Competitive differentiation</td>
<td>40%</td>
</tr>
<tr>
<td>EMEA</td>
<td>Internal process efficiencies</td>
<td>38%</td>
</tr>
<tr>
<td>APAC</td>
<td>Accelerating innovation</td>
<td>56%</td>
</tr>
</tbody>
</table>

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#
As digital technology develops, so too must the business model and the individual roles within an organization.

While digital transformation involves the application of technology, the real transformation it offers is that of the business model. Consequently, the people within businesses, from the senior management to the shop floor, must be readied, equipped and briefed to understand what will change, how it will change and how that will affect their own role.

At the top of the firm, an understanding of the impact digital will have upon cashflow is fundamental, as it will determine future staffing levels and resource requirements. Within middle management, the business must have clear sight into human resources (HR) issues and changes to skill sets, along with talent acquisition and retention policies. Non-management staff must be briefed to understand how and where they fit into these plans, so their capabilities are carried through and not lost. Collectively, this represents a shift in the culture of the firm.

They will need to adapt culturally to new digital models, including a greater openness and willingness to share. Some 31 per cent of respondents express a desire to increase collaboration, identifying ‘aftermarket/estimating’, ‘supply chain’ and ‘sales/bid management’ as the most lacking in this respect. There is a two-point gap in the delta between desired and actual collaboration, indicating that the potential level of collaboration industry insiders believe to be possible is still some way off.

The issue of collaboration does not appear to be an internal one – zero respondents report a siloed model of working and 57 per cent report a very strong level of integration and cross-departmental work. The success of projects such as those at AMRC will drive appetite for greater external collaboration. These demonstrate how collaboration can support the creation of new ideas, and allow firms to look at things from different perspectives.

Manufacturers need to understand that collaboration does not have to rely on rivals suspending their competitive nature. The breadth of companies that sit under the umbrella of manufacturing allows companies with similar circumstances but in a slightly different sub-industry, or a different type of manufacturing, to compare notes without exposing their competitive edge to their direct peers.

NEW OPPORTUNITIES

Understanding the extent to which digital technologies can transform a business is a key element of cultural transformation. While the cloud opens many new doors and underpins the use of digital technologies such as IoT, the real value is that digital technology allows leaders to look for new opportunities within and beyond their business.

As business models start to change, new departments will be created within companies. Where firms are following the servitization route, a service department will need to be created – which, in turn, offers opportunities for people to move from a production-focused job to a service role in the field. Senior management must convey this world of opportunity with enthusiasm, with HR as a key part of the digital technology transformation project.

One in four respondents report that a lack of skills

Further resistance to the digitalization of the business exists around the human fear of replacement by machines.
and talent present a barrier to change, implying that the workforce need both training and involvement. The greatest talent gap identified is in the areas of AI/robotics and business intelligence.

Reactions to this challenge are varied; 35 per cent of respondents feel either slightly or totally unprepared to deal with this talent deficit and more than one in five manufacturers feel they do not have ‘the culture and structures in place to adapt quickly and effectively to new processes and applications’ in the context of more fluid and transient workforce dynamics.

HR IS KEY

Further resistance to the digitalization of the business exists around the human fear of replacement by machines. However, this fear is somewhat misjudged as machines are actually enabling entirely new capabilities and ways of working. Despite this, 49 per cent of respondents in manufacturing do cite an aversion to change as the greatest barrier to digital transformation.

That should not be underestimated; firms need to develop their HR strategy so that employees can see that their futures are being effectively sustained, and that the company as a whole is moving forward. In many cases that will mean companies become skilled in new technologies, which can add to an employee’s value in the market too. For the business, that is predicated on an investment in training and talent. Leadership must buy in to the advantages on offer to them and be willing to show commitment.

In doing this, the company will become more attractive to new hires, who will see it as a progressive place to work. To be at the forefront of the manufacturing industry, having an effective HR department is key.

Clearly the leaders in manufacturing are aware of both the fears and the gaps in resource. And a desire to find talent and support it using the existing workforce is evident – 71 per cent of respondents are upskilling their existing talent, while 29 per cent of firms are also looking to find digital talent externally.
LEVEL OF INTEGRATION AND CROSS-DEPARTMENTAL VISIBILITY

1 = Departments operate in silos with limited visibility due to a lack of system integration
5 = Departments operate on fully integrated system

LEAST-INTEGRATED DEPARTMENT DYNAMICS

01
Aftermarket/Estimating – Supply Chain

02
Sales/Bid Management – Supply Chain

RESPONSE TO IMPACT OF DIGITAL DISRUPTION

01
71%
Upskilling of existing talent

02
41%
Investing in digital resources, technologies and assets

03
40%
Narrow and hone service/product offering

04
29%
External recruitment of digital talent

05
19%
Diversify service/product offering

COLLABORATION DELTA

GLOBAL MANUFACTURING INDUSTRY

NORTH AMERICA

EMEA

APAC

% OF RESPONDENTS

% OF RESPONDENTS

% OF RESPONDENTS
THE SIZE OF THE TALENT GAP

The talent challenges may be universal but the areas of focus, and ability to resolve, vary across the company size spectrum.

While larger manufacturers focus on the power of data, smaller manufacturers want to develop capability in digital technologies.

PRIORITY CAPABILITIES FOR DIGITAL TRANSFORMATION BY COMPANY SIZE

Although gaps appear to be most acute in smaller manufacturers, they are better prepared to overcome this hurdle.

PREPAREDNESS TO DEAL WITH TALENT GAP BY COMPANY SIZE
However, manufacturers are united in the talent challenge in BI and AI/Robotics, with big data and analytics a peripheral concern.

**FIVE BIGGEST TALENT GAPS BY COMPANY SIZE**

<table>
<thead>
<tr>
<th>Company Size</th>
<th>Project Management</th>
<th>Business Intelligence</th>
<th>Security</th>
<th>AI and Robotics</th>
<th>Big Data/Analytics</th>
<th>3D and 4D Asset Modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 - 4,999</td>
<td>8%</td>
<td>12%</td>
<td>24%</td>
<td>25%</td>
<td>24%</td>
<td>26%</td>
</tr>
<tr>
<td>5,000 - 9,999</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;10,000</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Of manufacturers of >10,000 do not have the culture and structures in place to adapt quickly and effectively to new processes and applications, higher than any other company size.

According to all manufacturers, upskilling existing talent will be a key response to digital change.

#1 RESPONSE TO THE IMPACT OF DIGITAL DISRUPTION

- **83%** UpSkilling Existing Talent
- **71%** UpSkilling Existing Talent
- **70%** UpSkilling Existing Talent
THE NUMBERS GAME

Using data-driven insight is key to moving a business forward, but many still lack the analytical capabilities to take full advantage of this valuable data

Big data and analytics’ is identified as the #1 capability for investment, and 26 per cent of manufacturers are ‘successfully harnessing data-driven insight to deliver faster time to innovation, which is a distinct competitive advantage for their company’. Yet while that is higher than in any other sector, it leaves 74 per cent of firms who are failing to harness data successfully. At the same time, 91 per cent of firms report that they have the right data to hand. This paradox implies that firms do not know how to analyze the data they have access to. From a digital evolutionary perspective, the deployment of cloud solutions as a repository for data allows for greater, easily accessible storage capacity. Finding the value in that data is another step along, however. This requires BI at the very least, big data and analytical capabilities more commonly, and, at the far end, the use of AI to analyze major data sets. Opportunity and understanding are key to realizing the value data can hold. Historically, data with a low perceived value may not have been retained, but the advent of low-cost expansible cloud storage allows it to be captured in order to detect opportunities when they arise. For example, having access to minute-by-minute records of warehouse temperature may not be useful day-to-day, but running an AI-based surveillance application trained on a historical dataset can allow a manufacturer to spot a problem before that temperature goes above a critical limit.

**MACHINE EFFICIENCY**

From a service point of view, a firm can add sensors to a product and utilize IoT to record and report on its use, with that data stored in the cloud. This low cost of entry into digitalization allows the firm to analyze that data and build a picture that will move it towards a servitization approach. Recurring contracts, with an informed just-in-time approach, can create both more satisfied customers and more efficient operations. In a normal workplace, the machines on the shop floor can provide a lot of information about their usage. When one breaks down, analysis of what caused it – which may involve data analysis from AI technology – can be used to spot what led to that failure. Making changes to improve the efficiency of the machine, such as a vibration sensor providing feedback, can flag when it moves outside of a certain tolerance guided by information on previous breakdowns. Therefore, rather than wait for it to break down, the firm can stop it, replace the worn part in a planned way and avoid an unplanned breakdown.

The majority of companies (58 per cent) are only ‘beginning to utilize data-driven insight, which is starting to have a positive impact on time to innovation, but it is not yet a competitive advantage’, suggesting these developments have momentum but are at an early stage across the industry as a whole.

Companies are clearly focused on their data strategy, given the targets for technology investment, however the results would suggest customers are not. Of the respondents, 62 per cent reject the statement ‘my customers increasingly demand to be able to access business-critical systems and information remotely’. The lack of interest in data among customers is higher than in any other industry. However, this is a natural reflection of the servitization of the manufacturing businesses; with clients having to manage less and providers managing more (as an inclusive part of the service offering), customers are trusting suppliers to manage the information themselves.

**UTILIZATION OF DATA-DRIVEN INSIGHT BY REGION**

<table>
<thead>
<tr>
<th>Region</th>
<th>Plans to utilize data-driven insight are still nebulous and will require the development of significant capability</th>
<th>We are beginning to utilize data-driven insight, which is starting to have a positive impact on time to innovation, but it is not yet a competitive advantage</th>
<th>We have plans to utilize data-driven insight for innovation but do not yet have the capability to do so effectively</th>
<th>We are successfully harnessing data-driven insight to delivery faster time to innovation, which is a distinct competitive advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORTH AMERICA</td>
<td><img src="image1" alt="10%" /> <img src="image2" alt="45%" /> <img src="image3" alt="45%" /></td>
<td><img src="image4" alt="10%" /> <img src="image5" alt="45%" /> <img src="image6" alt="45%" /></td>
<td><img src="image7" alt="10%" /> <img src="image8" alt="45%" /> <img src="image9" alt="45%" /></td>
<td><img src="image10" alt="10%" /> <img src="image11" alt="45%" /> <img src="image12" alt="45%" /></td>
</tr>
<tr>
<td>EMEA</td>
<td><img src="image13" alt="1%" /> <img src="image14" alt="18%" /> <img src="image15" alt="68%" /> <img src="image16" alt="12%" /></td>
<td><img src="image17" alt="1%" /> <img src="image18" alt="18%" /> <img src="image19" alt="68%" /> <img src="image20" alt="12%" /></td>
<td><img src="image21" alt="1%" /> <img src="image22" alt="18%" /> <img src="image23" alt="68%" /> <img src="image24" alt="12%" /></td>
<td><img src="image25" alt="1%" /> <img src="image26" alt="18%" /> <img src="image27" alt="68%" /> <img src="image28" alt="12%" /></td>
</tr>
<tr>
<td>APAC</td>
<td><img src="image29" alt="18%" /> <img src="image30" alt="46%" /> <img src="image31" alt="37%" /></td>
<td><img src="image32" alt="18%" /> <img src="image33" alt="46%" /> <img src="image34" alt="37%" /></td>
<td><img src="image35" alt="18%" /> <img src="image36" alt="46%" /> <img src="image37" alt="37%" /></td>
<td><img src="image38" alt="18%" /> <img src="image39" alt="46%" /> <img src="image40" alt="37%" /></td>
</tr>
</tbody>
</table>
PressurE to change

The manufacturing industry is facing ever-more disruptive forces, which are pushing organizations to invest in training, recruitment and the latest technological capabilities.

As disruption begins to bite, the average pace of change in a business is outpacing the ability of the jobs market to provide it with skilled workers, with a significant skills shortage existing around data scientists. There is a resistance to change where a firm wants to move to the cloud or toward automation because resources will be outsourced and jobs are perceived to be under threat. This causes stress within companies, and the realization that they need to do something or risk falling behind the curve further adds to that stress. The technology is available, therefore much of a firm’s success now depends on its ability to apply it, and to develop commercial models around it. Handling the pressure to change is very much a ‘people’ issue, from the shop floor through sales to board level.

Commercially, first movers will have an advantage as they set customer expectations and benefit from falling costs ahead of their peers.

Smart manufacturing

The new levels of automation and data usage found in the manufacturing business – Industry 4.0 or smart manufacturing – are an enormous and successful element of DT. Respondents report that 55 per cent have already transitioned to smart manufacturing, with a further 26 per cent expecting to do so within two years. Firms making the transition over a three-to-six-year time span are in single figures per year. Clearly, smart manufacturing is already well in progress, meaning the pressure on the laggard firms – some 18 per cent in total – is only going to increase.

‘Automation’ is reported as the greatest disruptive force facing the industry, while ‘robotics and automation’ are in the top five capabilities identified for investment. At a basic level, automation increases efficiency and productivity, such as in finance where invoices are processed using automatic matching and payment can be automated via distributed ledger models. However, it also has the potential to create valuable feedback loops through the application of AI – also rated highly for investment – allowing for ever more complex tasks to become automated. What this will mean for the business is a real-time understanding of activity and a more granular cash flow that reflects real-time awareness of need.

The other notable investment target, ‘3D/4D modeling’, is indicative of the move toward faster production and 3D-printing capabilities. The primary drivers for smart manufacturing – ‘production time’, ‘delivery reliability’, and ‘customer satisfaction’ – are on the one hand enabling this transition to faster production/a service-led approach, and on the other hand pushing firms to invest in the latest capabilities to stay ahead of the pack.

Servitization

Servitization is very disruptive, requiring a different mindset at a senior level within the business. Firms are no longer only building products, they are effectively selling the capabilities their products offer, but as a service. With 68 per cent of respondents claiming that servitization is either ‘well-established and is already paying dividends’ or ‘in progress and is receiving appropriate executive attention and support’, it is already a dominant trend within the industry.

This new mindset will impact the approach firms take to manufacturing their product. For example, the case for cheap disposable products may be changed when a service contract is imposed. Instead of opting for lower production costs, making the product as reliable as possible becomes the key driver, because the service contract means the cost of any regular stoppages or faults are passed on.

Firms benefit from lowering the total cost of ownership – rather

"The technology is available, therefore much of a firm’s success now depends on its ability to apply it"
than providing one large payment on delivery of a product and then nothing for 12 months, they will pay a smaller amount per month, with quality assurance built in.

**FINDING A SOLUTION**

In addition to the need for a service department, salespeople will also have to change the way in which they sell, and become versed in promoting a solution rather than a product. That means engaging in a more involved process to understand the client’s problem and provide a contract that takes as much stress out of that problem as possible.

However, the reality is that only 25 per cent of respondents are seeing ‘dividends’ from the investment so far. That necessitates an appraisal of the respective merits of servitization. An added nuance to that appraisal is the finding that the majority of manufacturers see servitization as a necessary step to keeping pace with a moving marketplace rather than giving that crucial edge over the competition. To keep pace with their peers or to get ahead, firms will need to accelerate their adoption of DT.

The strategic approach to handling digital disruption requires a clear assessment of progress within the sector as well as within the individual firm. There are skills gaps, there are cost pressures, and there is resistance to change. Where firms are not able to achieve digital transformation, the use of third parties can quickly bring in much-needed skills and resource.

Some 81 per cent of respondents in manufacturing overall believe ‘the company’s current third-party vendors are equipped to provide for future digital needs’. The results show manufacturers see third parties playing key roles in ‘digital organization and operations’, ‘performance analytics and reporting’, and ‘digital strategy’.

The latter is particularly pertinent as, looking across sectors, this was not realized as a ‘top five’ value that providers can offer. Turning to experts can provide the acceleration needed to break away from the herd.

There is broad engagement with digital transformation in the manufacturing sector, but its depth varies widely between firms. As the industry is transformed, its leaders have established digitalization strategies for their tools and processes in order to bring their business into a more highly sustainable, less volatile revenue model. As competition intensifies, manufacturers will need to take every advantage they can to get ahead. That will mean an assessment of internal resource, a careful appraisal of third parties and a well-communicated, top-down approach that allows the best of current talent to be carried into the digital future.

"To keep pace with their peers or to get ahead, firms will need to accelerate their adoption of DT"
WHERE SERVITIZATION PLACES COMPANIES IN COMPETITIVE LANDSCAPE

% OF RESPONDENTS

- 27%
- 13%
- 5%
- 5%
- 4%

A. The move to servitization has given my company a competitive advantage and enabled us to increase market share and grow existing accounts
B. The advent of servitization in the industry has left my company lagging behind the competition and resulted in account contraction and/or a loss of market share
C. Servitization is not applicable to my company

THE JOURNEY TO SERVITIZATION

% OF RESPONDENTS

- 25%
- 43%
- 15%
- 9%
- 7%
- 1%

A. Servitization is well-established and is already paying dividends
B. The move to servitization is underway but we are not seeing the desired progress and greater executive support is required
C. Servitization is a priority item on the executive agenda for 2017
D. Servitization is not a near-term strategic priority
E. Servitization is not applicable to my company
F. The move to servitization has kept my company abreast of competitors but has not resulted in a competitive advantage

DRIVERS BEHIND SMART MANUFACTURING

% OF RESPONDENTS

- 50%
- 47%
- 52%
- 15%
- 43%
- 1%

A. The move to servitization has given my company a competitive advantage and enabled us to increase market share and grow existing accounts
B. The advent of servitization in the industry has left my company lagging behind the competition and resulted in account contraction and/or a loss of market share
C. Servitization is not applicable to my company
D. Servitization is well-established and is already paying dividends
E. The move to servitization is in progress and is receiving appropriate executive attention and support
F. Servitization is a priority item on the executive agenda for 2017
This research was commissioned to capture the current position, challenges and goals of companies in the manufacturing industry. The insight will be used to inform and steer companies through their transformative changes, as well as guide IFS in refining its expertise and solutions.