

Irish Medtech
Association
Ibec

A hand holds a tablet displaying a blue-toned interface with various charts and data points. Overlaid on the image is a large, semi-transparent circular graphic with concentric rings, tick marks, and several white and blue dots, resembling a radar or a data visualization. The background is a blurred industrial setting with mechanical parts and a robotic arm, all in shades of blue.

The race to embrace digital manufacturing: **Lessons from Ireland's journey**



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Ireland's journey as a global manufacturing leader continues

Ibec Medtech and Engineering Director
Sinead Keogh



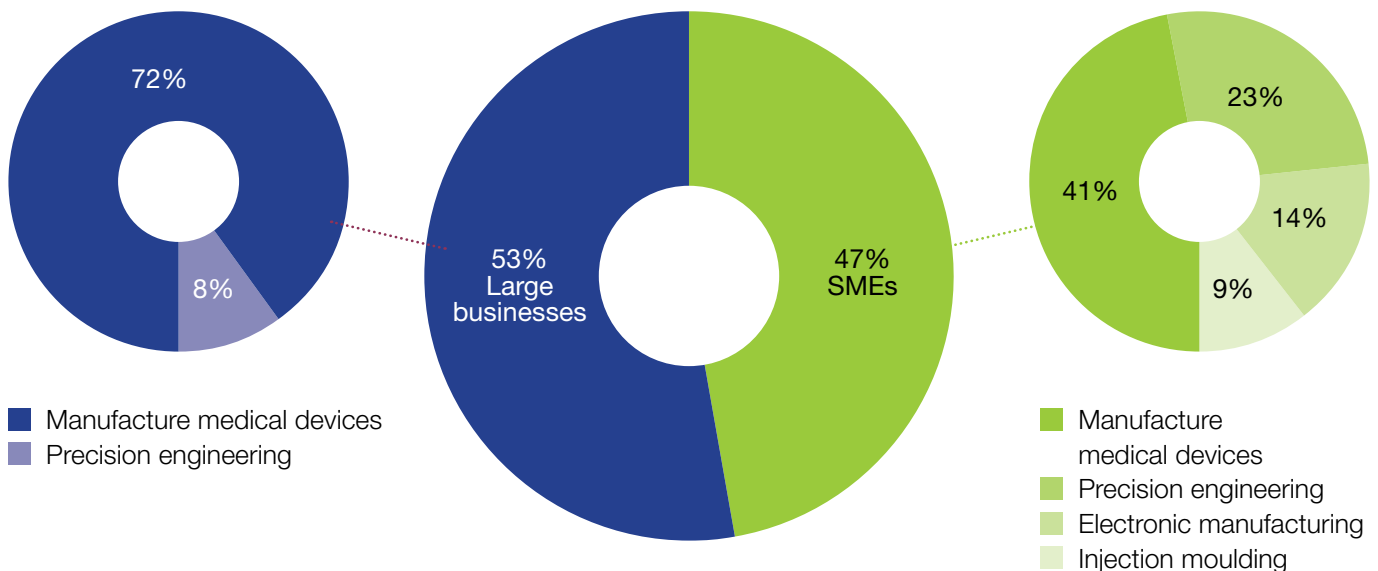
The world is moving at an incredible pace with many new challenges being presented, such as, global trade and tariffs, technological disruption, customer expectations, climate change and changing geopolitics. That's why Ibec Medtech and Engineering worked with leading FDI multinational and indigenous companies, both big and small, to understand their industry 4.0 journey with a survey to identify challenges and opportunities.

Manufacturing is a vital part of the Irish economy with more than 4,000 businesses employing in excess of 250,000 people. Manufacturing in Ireland contributes 35.5% of the total economy value added, well above the EU average of 14.4%.

Ireland is recognised as a leader in manufacturing with the greatest number of Shingo Prizes for operational excellence, per capita, in the world, but we need to look to the future and embrace new technologies to remain global leaders.

This survey was conducted to gather information on R&D innovation capabilities, strategies, and investment in advanced manufacturing.

Who responded



What is the digitalisation of manufacturing?

According to member businesses the digitalisation of manufacturing relates to the automation of manufacturing (51%) and the development of digital business models/services (49%). More than four out of five members said that automation of manufacturing was critical and two thirds of Ibec members surveyed said that their company was already implementing automation.

In terms of technology, almost all (92%) respondents identified robotics as important, 83% identified AI and data analytics, with 79% focusing on additive manufacturing and 3D printing.

Ibec Medtech and Engineering have called on the Government to take leadership and invest ambitiously in a large-scale centre that supports collaboration to help manufacturers take new technologies from proof of concept to commercialisation as this is a major gap in the innovation ecosystem.

While the IDA-led Advanced Manufacturing Centre will help companies de-risk the commercialisation and collaboration more investment is needed to ensure the centre is of sufficient scale. This is needed as a critical piece of national infrastructure. Centres like Tyndall (ICT), NIBRT (biopharma), and Teagasc (agri-food), have already paid dividends for other sectors. Manufacturing accounts for nearly a third of Irish GDP, to realise the sector's potential we need the right business environment or Ireland risks losing out to competitor economies that are already investing ambitiously.

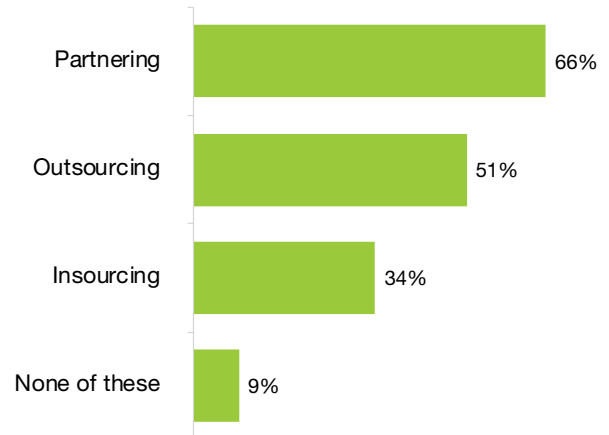
Ireland is a location of choice for global manufacturers and a great place to start a businesses. The sector is optimistic about growth potential for manufacturing with the businesses surveyed indicating that they are investing in new equipment and technologies.

With the right innovation and business supports Ireland can continue to be a leader in global manufacturing. Businesses here are ambitious about the future. As many as 89% of respondents said that they are investing in R&D, 96% are launching new products and services and an incredible 96% are planning to hire more staff. However, these jobs, investments and future innovations are at risk if we don't have a discrete manufacturing centre of scale to help the manufacturing ecosystem stay ahead of R&D and technology trends.

Advanced Manufacturing

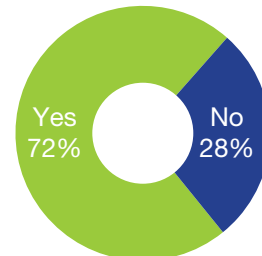
(Base: All member companies n=47)

When it comes to Advanced Manufacturing, do you rely on any of the following?

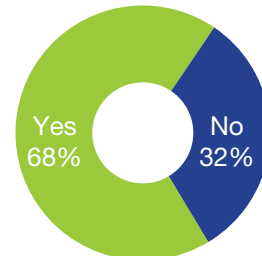


When it comes to Advanced Manufacturing R&D, does your organisation...

Use internal R&D on site



Use external R&D off site



Significant difference @ 95% confidence level

The majority (98%) of member companies consider the supply of skilled labour to be a challenge to their business, with just over 6 in 10 (62%) member companies believing it to be a major challenge. Almost all (96%) member companies consider technology advancements to be a challenge to their business.

Key stats



More than 80% of companies said automaton of manufacturing was critical to their future success

67% of companies are implementing automation in their manufacturing process



As many as **57%** said their approach to adopting new technologies was business driven

One of the greatest barriers identified is difficulties integrating new technologies identified by nearly half (**49%**)



92% of respondents identified robotics as important, **83%** identified AI and data analytics, with **79%** focusing on additive manufacturing and 3D printing

As many as **89%** are investing in R&D, and **96%** are launching new products and services



An incredible **96%** planning to hire more staff

Working together: End-to-End Advanced Manufacturing

Irish Medtech Association Senior Executive,
Adrienne McDonnell



Irish workers are the most productive in the world, adding an average of €90 to the value of the economy every hour they work, according to the OECD, compared to the US at €65, UK at €55, and EU at €51. This makes Ireland, with its rich talent pool and stable business environment, a location of choice for industry 4.0.

The Ibec Medtech and Engineering End-to-End Advanced Manufacturing Group is open to members of the Irish Medtech Association, Polymer Technology Ireland and Ibec Engineering Network. This working group supports best practice sharing in the area of advanced manufacturing benchmark visits for Operational Excellence and Industry 4.0, along with market insights, skills training and policy development.

The Irish Medtech Association launched its own Operational Excellence Benchmark Model, the MÓR™ Model, five years ago to help businesses monitor, optimise and realise their lean journey.

This unique model was developed by member companies to share best practice by combining journey planning, with tools to help businesses assess their performance, build maturity, and gain industry recognition. More than 100 companies have completed MOR™ Model training, with successful mentorships helping companies to build on their strengths. We are moving on as a manufacturing hub and need to also modify and enhance this model of operational excellence to advance with the times. That's why a new MÓR 4.0 model is the next project for the End-to-End Advanced Manufacturing Working Group.

Ibec Medtech and Engineering are helping members start and advance on their journey by providing access to key opinion leaders with the 'Manufacturing the Future Conference', lobbying key stakeholders on issues such as the call for government to invest in a discrete advanced manufacturing centre of scale, as well as upskilling with First Polymer Training and the Irish Medtech Skillnet.

At the end of 2019, Ibec Medtech and Engineering with the Irish Medtech Skillnet launched a first-of-its-kind Masters of Engineering in Digitalisation of Manufacturing. This new masters was developed to help business in Ireland embrace industry 4.0, to get ahead of international trends, adopt new technologies, and ensure that people working here are equipped for the jobs of the future. This structured masters combines specialist modules, online lectures, workshops and on-site visits to create 'Digital Champions'. This practice-based masters is aimed at professionals in manufacturing and will cover a range of cutting edge technologies such as data analytics and machine learning, 3D and virtual reality, robotics, the Internet of Things, and more.

The End-to-End Advanced Manufacturing Working Group's brings together leading businesses to achieve the full potential of the cluster by:

- + Building awareness of the value of discrete manufacturing industries
- + Developing the existing manufacturing base with investments in Industry 4.0 and policies that support business growth
- + Targeting training to help develop the talent pool here and make Ireland an attractive employment destination
- + Promoting collaborative relationships amongst stakeholders nationally and internationally



The Irish Medtech Skillnet is the national learning network for medtech businesses of all sizes to share best practice and to respond to their business needs. The network provides strategic responses to emerging opportunities and challenges with industry-led, specialised education and training for the medtech industry. Courses developed to help manufacturers compete and thrive include:

- + MÓR™ Benchmarking Model to identify gaps in your lean journey
- + Driving Operational Excellence through Lean Leadership (Level 9)
- + Masters of Engineering in Digitalisation of Manufacturing

This successful network has already delivered more than 46,000 training days and over 8,900 trainees have completed their programmes in a broad range of key areas. Training is government subsidised and offered at a competitive rate.

Irish workers are the most productive in the world, adding an average of €90 to the value of the economy every hour they work

Irish manufacturing companies progress

Ireland's manufacturing success is built on a strong foundation of operational excellence as exemplified by the fact that Ireland is the greatest recipient of Shingo Prizes, per capita, in the world.

Irish Shingo Prize winners include Abbott Nutrition Supply Chain Facility, Sligo (2018); Boston Scientific Cork (2016); Abbott Diagnostics Longford (2015); DePuy Synthes Ireland (2014); and Abbott Vascular Ireland (2014), along with Shingo Bronze Medallion Lake Region Medical (2015); Covidien (2013); and Lake Region Medical Limited (2012).

Operational Excellence is about aligning all areas of the business with your overall business strategy. This requires thorough enterprise-wide understanding of the value chain impacts, critical paths and value stream. But, in order to advance on the factory 4.0 roadmap, it also requires parallel strategic formation, implementation and sustainment of key elements in that business model.

These include:

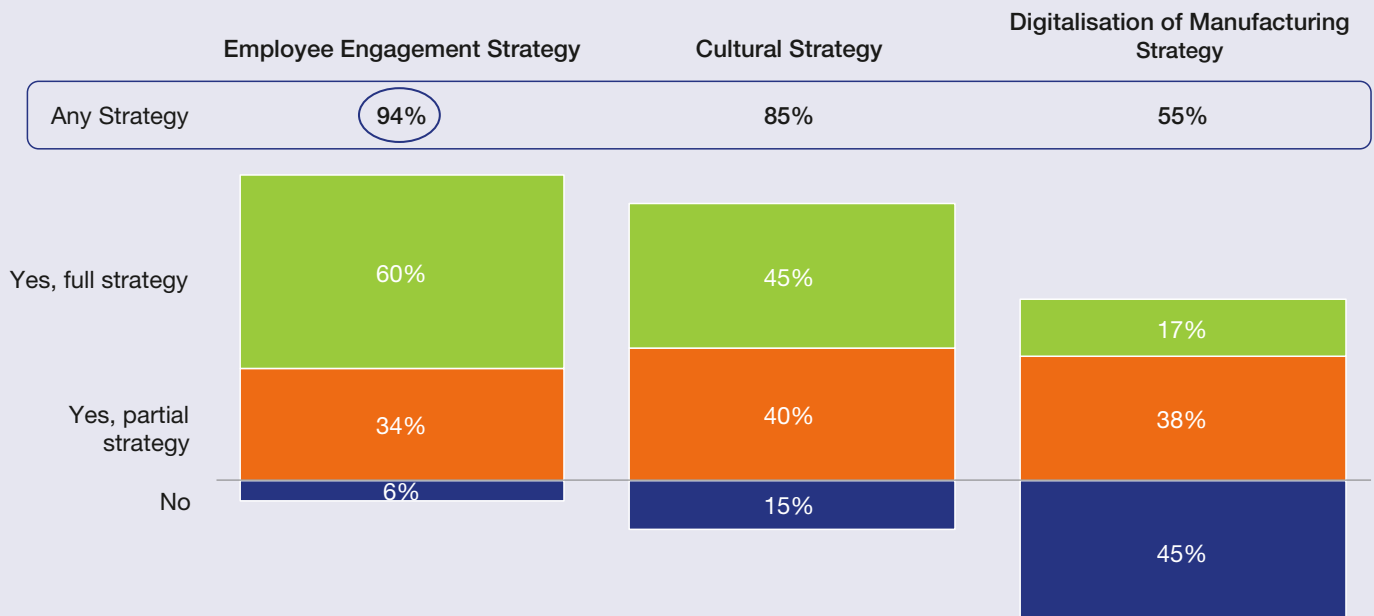
1. Employee engagement strategy;
2. Cultural strategy; and
3. Digitalisation of your manufacturing strategy.

Interestingly, when members were asked if they have these three elements, more than one in two respondents (55%) said that they have either a partial or full digitalisation of manufacturing strategy. It is clear, that while Irish manufacturing companies are progressing on the digitalisation journey, they still have a long way to go, to move towards Operational Excellence in this specific area. However, three years ago Siemens Ltd. administered a similar survey which showed that only 60% of companies had fully implemented a digitalisation strategy. This suggests progress of a rate of 5% year on year, which is a positive result.

Overview of Company Strategy

(Base: All member companies n=47)

Does your company have a...



Significant difference @ 95% confidence level

Just over 9 in 10 (94%) member companies claim they have some level of employee engagement strategy, although a third claim this is just a partial strategy. Just over half (55%) of member companies claim to have a digitalisation of manufacturing strategy, although less than 1 in 5 (17%) claim to have a full strategy.

Digital disruption and new technologies

As we plan for the future we need to look beyond OpEx, factories need to go digital with industry 4.0 to compete. Creating 'smart factories' with people-centred operations will support new ways of delivering manufacturing innovation. Operational excellence as a function is nearing overload and we've moved to an age of design thinking and digital transformation. Operational excellence needs to involve design thinking to understand customer needs and then design the 'idea process' embracing new advanced technologies. Organisations need to evaluate current employees for digital knowledge that could be put to use in various

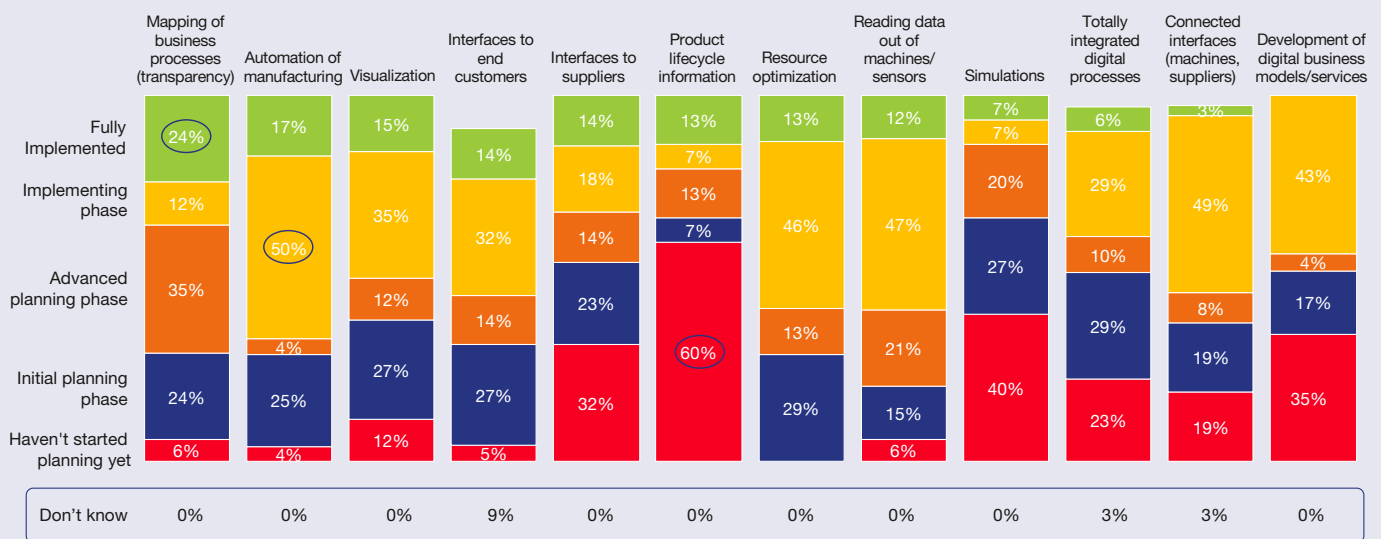
areas of the business. Companies will also need to engage in horizon scanning to identify new capabilities externally to build a new inflow of digital talent and maintain the talent continuum. Sourcing talent with agile, flexible and inquisitive minds will be key to further developing the future skill-base for implementing industrial digital transformation.

As many as 57% said their approach to adopting new technologies was business driven, but one of the greatest barriers they identified by nearly half (49%) is difficulties integrating new technologies.

Phase Companies are at in Terms of Technology Implementation/Integration

(Base: All member companies n=47)

In your opinion, what phase are you in within your company in terms of the implementation/integration of this technology



○ ○ Significant difference @ 95% confidence level

Almost a quarter (24%) of member companies claim that they have fully implemented the mapping of business processes with half of member companies (50%) claiming that they are in the implementation phase of the automation of manufacturing. However 6 in 10 member companies (60%) claim that they haven't yet started the product lifecycle information phase.

Key report findings

- 1. 7 in 10 member companies (70%)** claim that they are planning to apply software and apps in their business environment, while just over **6 in 10 member companies (64%)** claim that they are planning to apply connectivity and/or Internet of Things in their business environment.
- 2. Almost 8 in 10 (77%) member companies** claim that they expect increased resource efficiencies as a benefit from digitalisation, with the same proportion expecting greater transparency in their business processes.
- 3. Two thirds (66%) of member companies** claim that they are expecting improvements in quality and in profit/margins as a result of digitalisation, with just over **4 in 10 (45%) member companies** believing that quality and profit/margin improvements would have a major impact on their organisation.
- 4. Just over 9 in 10 (94%) member companies** claim they have some level of employee engagement strategy, although a third claim this is just a partial strategy. **Just over half (55%) of member companies** claim to have a digitalisation of manufacturing strategy, although less than **1 in 5 (17%)** claim to have a full strategy.
- 5. 7 in 10 (70%) member companies** claim that a better understanding of methods for analysing and adapting processes and the integration and/or further training of employees is critical in driving their organisation's digital strategy.
- 6. Almost half (49%) of member companies** claim that difficulties in integrating new technologies/software is holding them back from making greater use of digital technologies and processes in their organisation. Further to this, **just over 2 in 5 (43%) member companies** claim that not having enough experience internally with analysis of large amounts of data is holding back the use of digital technologies and processes.
- 7.** Overall, the rating of digital skills held within member companies is low, with just **11% of members** rating the level of skill held internally on any one aspect as "very high".
- 8. Almost 6 in 10 member companies (57%)** would characterise their approach to adopting new and emerging technologies as business driven, with **almost a third (32%)** characterising their approach as being technology driven.
- 9. Two thirds (66%) of member companies** claim they rely on partnering when it comes to advanced manufacturing with more than half (51%) claim that they also rely on outsourcing. **Just over 7 in 10 (72%) member companies** claim that their organisation uses internal R&D onsite, while **just over two thirds (68%)** claim that their company uses external R&D off-site.
- 10. Half (50%) of member companies** think that upskilling the current and future workforce should be the Government's number one priority in supporting the manufacturing sector. Tax incentives and maintaining competitiveness are also considered priorities (**both 22%**).

The business case

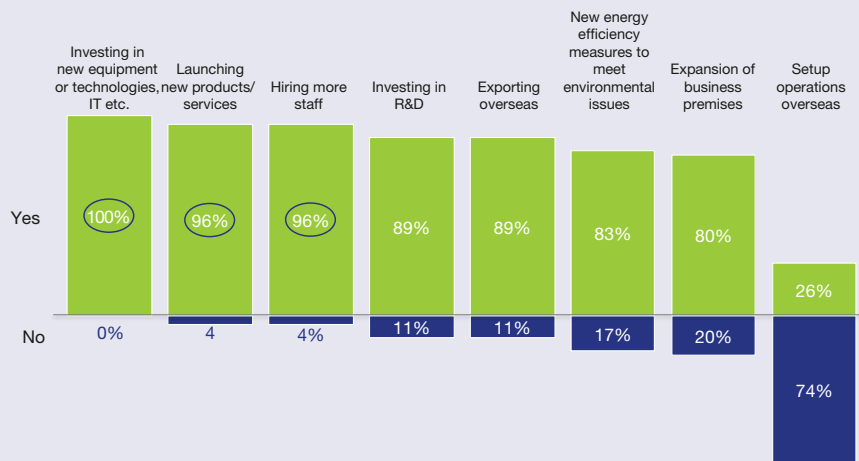
The business case for industry 4.0 is clear according to DePuy Synthes and Thormac. Industry 4.0 is worth investing in as it improves outcomes and reduces failures. Advanced manufacturing is changing the way businesses develop their products which helps to

boost customer satisfaction. Smart factories and data is already helping businesses work smarter rather than harder, and to compete companies must invest in it to ensure their longterm success.

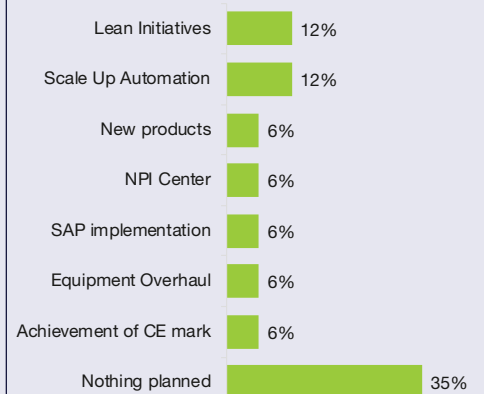
Plans for Initiatives for the Business in the Next 3 Years

(Base: All member companies n=47)

Are you planning any of the following initiatives for the business in the next 3 years?



What other initiatives are you planning for the business in the next 3 years?



○ ○ Significant difference @ 95% confidence level

All member companies (100%) claim that they have plans to invest in new equipment or technologies in the next 3 years, while the majority of member companies claim that they are planning on launching new products/ services or hiring more staff (both 96%).



Mike Flannery
*DePuy Synthes Director of
Technology Development*

Why one of the world's leading manufacturing facilities is here

In a world of changing markets, shorter product cycles, higher product complexity and global supply chains, companies are seeking to become more flexible and responsive to manufacturing trends. Industry 4.0 has the power to drive quantifiable change in the manufacturing industry. The immediate bottom-line production benefits are evident: fewer machine failures, less scrap and downtime issues, faster implementation and improved outcomes.

Efficiency

Almost 8 in 10 (77%) of Ibec member companies claim they expect increased resource efficiency as a benefit from digitalisation, while the same proportion expect greater transparency in business processes. The use of intelligent technologies is fundamentally changing the way companies develop products, retrieve information from products and improve future products.

With its manufacturing facility based in Cork, DePuy Synthes – a Johnson & Johnson medical device company – delivers innovative medical devices and solutions in orthopaedics, spinal care and neuroscience.

Named as one of the top twenty most advanced manufacturing facilities in the world due to its use of Internet of Things (IoT) technology, DePuy Synthes has implemented a number of technologies over the past 5-6 years. Director of Technology Development Mike Flannery says, "The implementation of Industry 4.0 allows us to connect our manufacturing processes – unlocking new levels of innovation and capabilities. Leveraging IoT technologies allows us to harness operational data to improve our focus on customer satisfaction and clinical outcomes, while also strengthening our operations through greater visibility, efficiency and control."

One such example is the implementation of device-to-device communication, whereby machines pass data to each other using protocols. This does not always mean newer, more expensive machines. The DePuy Synthes manufacturing facility has used IoT devices across a range of their original machines to create real-

time digital twins of its manufacturing equipment for advanced machine insights. This has resulted in a 10% reduction in operating costs, and a 5% reduction in machine downtime.

The intelligent networking of machines and systems in the IoT helps to maintain an overview of details from technical development to production. If the machine data is visible and can be displayed in the context of use, it can be used for analyses. Carrying out medical device manufacturing processes manually or in separate, unconnected systems leads to a significant increase in effort, which can no longer be mastered due to the increasing shortage of skilled workers.

Talent

70% of Ibec member companies feel the integration and/or further training of employees, and a better understanding of methods for analysing and adapting processes, are critical to be able to drive their digital strategy implementation. Mike Flannery comments, "Talent is becoming an important differentiator – especially in specialized fields like automation and software engineering. Getting the right person with the right capability is critical for any project success. For any company, creating talent pathways for new graduates, as well as evolving capabilities, is vital for the future. We do this in part through training and development programmes that focus on upskilling, co-op programmes, and collaborative partnerships with third-level institutions, including the Irish Medtech Association and by leveraging the Ibec Apprenticeship Programme."

36% of Ibec member companies are finding technology advancements a major challenge and Flannery says, "We developed a digital systems architecture which adheres to ISA-95, the international standard levels of manufacturing production, from level 0 – the physical production – straight to level 4 – business planning and getting processes right. We have a clear vision in terms of leveraging our manufacturing information and controlling our product design."

It is challenging to get an off-the-shelf solution for a specific business, as each company has different needs; this results in many companies co-creating solutions. "Some of the biggest medical device/lifesciences companies are here in Ireland," says Flannery. "We have an unprecedented opportunity to collaborate effectively together and to learn from one another."



Sean Ryan
Thormac
Managing Director

A 10 year journey to embrace the future of manufacturing

For all manufacturers, particularly SMEs, to compete at either a global or local level, industry 4.0 will have to be embraced in order to enable more efficient, responsive and accurate production, and greater control over their operations. Efficiencies will ensure the long-term survival of a business and ensure they stay ahead of the crowd.

According to 60% of Ibec Medtech and Engineering member companies, a greater knowledge of future market requirements and of trend forecasts is a critical aspect in driving their digital strategy implementation. If businesses stand still for too long, they will be overtaken by those businesses who have committed to change, are keeping up-to-date with future market requirements, and constantly evolving to the next level.

Sean Ryan, Managing Director at Thormac – which is a leading custom plastic injection moulder and contract manufacturer, operating in Shannon since 1979 – comments, “We have been on our digitalisation journey for the past 10 years and still are because it is something businesses can continuously improve. Automation has become a huge benefit for us, because as a small company, it makes us competitive.

“Our digital strategy is about staying ahead of the competition in Europe and the Far East, which has a large injection moulding industry. Within the last couple of years, we have implemented visual management tools, which provides data at a glance, and an ERP (Enterprise Resource Planning) system, which fully integrates all facets of operation, such as product planning and development, and sales and marketing. This has strengthened our ability to manage the company more effectively and more energy efficiently. Digitalisation is all about working smarter, rather than harder.”

Finance

A mitigating factor in the lack of investment in digitalisation by some companies can be a lack of resources, either financially or human. 30% of Ibec Medtech and Engineering member companies stated access to finance as a major challenge posed on business. “Putting aside enough money to finance the new advancements is a challenge; naturally, it can be easier for multinationals,”

says Sean Ryan. “But the investment is worth it, because it has given us the capacity to work around the clock and deliver to our customers in Ireland and worldwide.

“One of the great things about Ibec is that you can interact with multinationals who have spent the money on technological advancements and they can tell you their pitfalls.”

Cultural attitudes

49% of member companies said difficulties of integrating new technologies or software was an internal barrier holding back the use of digital technologies in the workplace, while 43% said another internal barrier was ‘not enough experience with analysis of large amounts of data’.

“Integrating new technologies can often be a cultural challenge for some businesses,” says Ryan. “The whole idea of new technologies can create an element of fear – people often develop an emotional attachment and can’t understand why a machine that is still working should be replaced at all.”

Meanwhile, 62% also said supply of skilled labour is a major challenge. While finding the right people with the right skills can be difficult, there are opportunities. Ryan says, “we try to train people in-house and through initiatives such as Ibec Medtech and Engineering Skillnet, a collaborative learning network to address the skill needs in the industry.

“It is difficult for an SME to digitise, there’s no doubt about that. But it’s important that they do. It really is about finding an affordable solution. It’s not as easy as it sounds, but you just need to do the work. Certainly, Ibec Medtech and Engineering can support this.”

Opportunities

While 30% of companies claim Brexit to be a major challenge, there is huge opportunity for Irish Medtech and Engineering companies to expand their businesses into Europe and beyond. “Supplying to the UK is now an issue, however we have been looking towards other markets such as Germany,” says Sean. “It’s difficult, but we are seeing some traction.

“Ireland has an excellent manufacturing industry; we have the highest minimum wage in the EU, and the second highest in Europe. We have to be competitive and work a lot smarter. Allocating resources for industry 4.0 is important, but so is the attitude within the company. The culture of the business also needs to be geared up for change. There’s no point investing in digital innovation if the culture of the business cannot support it.”

Technology

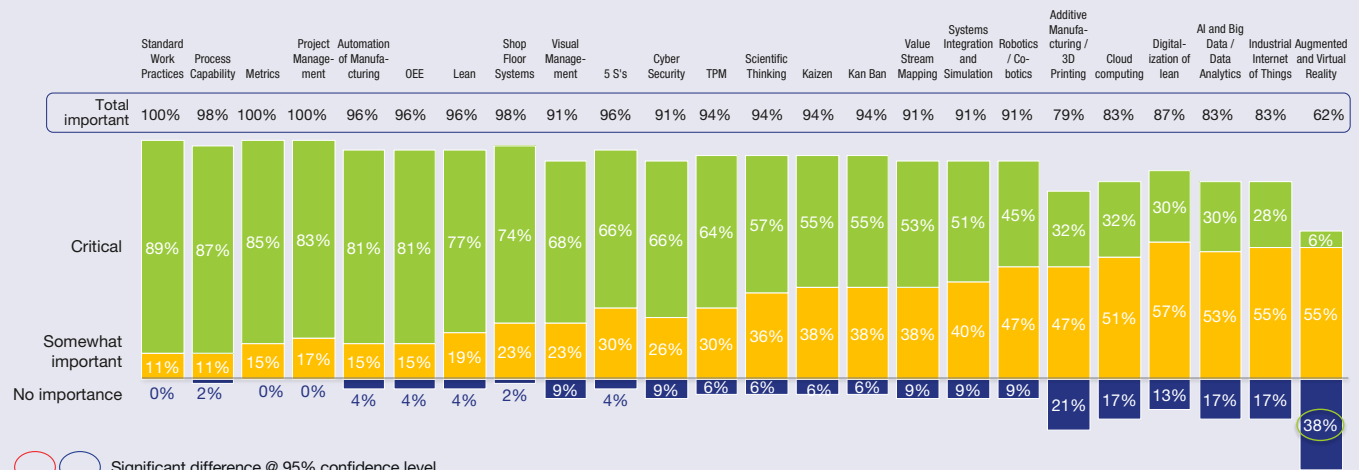
Embracing technologies is accelerating the pace of innovation and data is improving decision making, but there are challenges in integrating new technologies according to Siemens, Boston Scientific and West. When new ways of technology are introduced, you

need to bring your team along with you to reap the benefits of your investments. Moreover, you need to have a clear purpose before adopting new technologies and you should start small to succeed.

Phase that Companies are at in Terms of Technology Implementation

(Base: All member companies n=47)

Please rank the list of manufacturing topics in order of priority using the scale provided



The majority of topics are deemed to be of critical importance in manufacturing with standard work practices, process capability, metrics and project management deemed to be of most critical importance.



Gerry McNamee
Siemens Healthcare
Diagnostics Business
Excellence Manager

Integrating new technologies to add value

According to research from Ibec Medtech and Engineering, a large percentage of companies have plans to apply new technologies in their business. 70% claim that they are planning to apply software and apps while 64% claim that they are planning to apply connectivity and/or Internet of Things. Gerry McNamee, Business Excellence Manager for Siemens Healthcare Diagnostics in Swords, says that Industry 4.0 has been in development for years and technology has been improving and changing in line with it.

"We have been manufacturing instruments for 53 years and we have been continuously improving and transforming," says Gerry McNamee. "At Siemens Healthineers, the instruments that we make take several years to design and create. Our industry moves

relatively slowly so embracing new ideas and tech is changing and speeding up how we do things."

Siemens Healthcare Diagnostics operates in the industry, energy and healthcare sectors and is a state-of-the-art manufacturing facility producing and supporting complex medical diagnostics analysers for a worldwide market. Like any company investing in new technologies, there have been challenges in integrating the tech.

Smart work practices

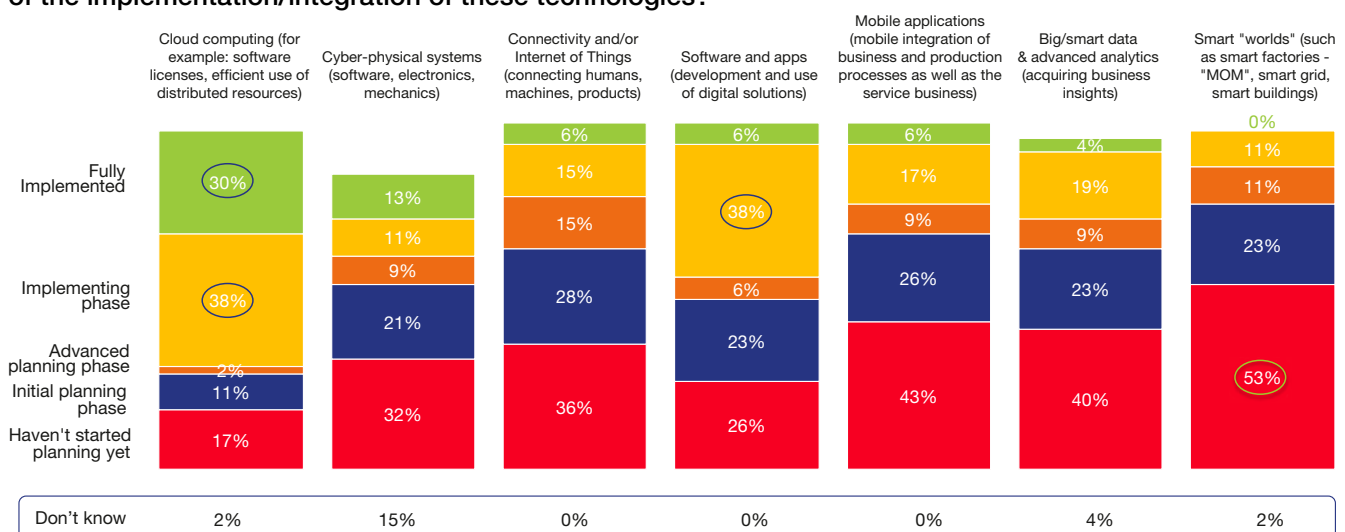
Industry 4.0 utilises cloud computing (which 57% of companies plan to implement) and smart data and analytics (which nearly half of companies have planned). This takes processes normally managed internally by both people and machines and moves them into the cloud where they can be managed from anywhere in the world. This represents a large change when practiced in a real world environment.

"Similar to introducing lean or operational excellence, these new ways of working are a big change for people," says McNamee. "When we are introducing anything, such as a new piece of software, we like to

Phase that Companies are at in Terms of Technology Implementation

(Base: All member companies n=47)

In your opinion, what phase are you in within your company in terms of the implementation/integration of these technologies?



Significant difference @ 95% confidence level

3 in 10 member companies (30%) claim that their company has fully implemented cloud computing software licenses and efficient use of distributed resources. However, more than half (53%) claim that their company hasn't yet started planning the implementation of "smart worlds".



Colm Sheils
*Boston Scientific
Galway Operations
Director*

make sure that the broader team is involved. It will be a collaboration between engineering, logistics, operators the technicians to see what they can get out of it, what are the benefits and what are the challenges.”

89% of companies place standard work practices as critically important to manufacturing. Gerry McNamee says a successful implementation in the workplace is a balance between the traditional and the new. “You can invest all the money you like into software, hardware and robotics, but if the people working with the tech don’t embrace it, then it won’t work as well as they could. It’s the same challenge that’s been around since the beginning of manufacturing.”

The future of digitalisation

There are 39% of companies planning on implementing data visualisation/data analytics in the next one to three years, and just over one in five claiming that they are planning the implementation of Virtual Reality/Augmented Reality and 3D-printing in the same period. Companies appear to be embracing digitalisation projects for the future of the industry. But Gerry McNamee says companies must have a clear purpose for integrating new types of technology and digitalisation.

“We have what is called a workplace knowledge system which is a system for capturing and sharing knowledge between employees. We have been looking at computer software for plant simulation and 3D layouts. Eventually we will have a VR cave, where you put on goggles and actually walk through the plant, or walk in a virtual cell, deciding where everything should be. We know these projects will benefit us in the long-run.”

Gerry McNamee advises, “Implement technology only if it will improve the business. At Siemens Healthineers, we know the steps we want to take this year and next year and have set ourselves some budgeting constraints. We will either stop spending, if it turns out not to be a good route or invest some more money because we see the benefits.”

McNamee says they have learned about new tools and benefits of new tech through the Ibec Medtech and Engineering working groups.

“By participating in these groups, we learn new things, we make the network connections with other companies and industries and see some of their industry 4.0 labs. It is a great network to be a part of. The more you put into those networks, the more you get out of them.”

How technology can reduce costs while increasing benefits

From front-end technologies such as smart manufacturing, to base technologies - the Internet of Things, cloud computing, and data and analytics - companies are embracing new advancements under Industry 4.0. However, there can be a lack of understanding of how they can implement these technologies.

According to Ibec Medtech and Engineering research the automation of manufacturing, robotics/cobotics and artificial intelligence with standard work practices, additive manufacturing/3D printing and lean manufacturing are critical to the future of manufacturing. But what are the main drivers of investing in and adopting new technologies?

Colm Sheils, Operations Director at Boston Scientific Galway says that the main reasons to adopt new technologies are numerous but quality and compliance would be top of our list. “Investing in new technology gives benefits across safety, quality and cost. The advancement of these technologies in recent years means that automation costs less to do with even greater benefits.

Automation and remote support can maximise the benefits from technology investments. All new equipment installed in recent years is connected to our databases and constantly stream large amounts of data to those databases. This data is then transformed into really useful information through internally developed “Apps” that link employees to the data quicker, so they can make more informed decisions. Employees can also learn to operate new equipment through virtual reality, or see a prototype’s faults before finishing the product. The possibilities are endless with industry 4.0.”

“Implement technology only if it will improve the business”



Cormac Ashe
West Pharmaceutical
Services Inc
Senior Director Sales
and Development
Engineering

Digital advancements

"It completely depends on each individual company and where they are on their digital journey they are, but digitalisation is vital to most companies in the industry," says Sheils. "More and more we move non-proprietary data to the cloud but the analytics to extract valuable information from that data is done in-house and has been a key focus area over the last few years ."

Boston Scientific, which is turning 40 this year, is a global leader in the development of minimally invasive medical devices for a range of medical conditions and is celebrating 25 years in Galway this year. Like most medtech companies, Sheils says that digitalisation is very important to their organisation especially in the area of robotics and vision systems to replace manual inspection.

According to Ibec Medtech and Engineering, 30% of companies say that their company has fully implemented cloud computing, with another 40% of companies at the advanced planning and implementing phase. 30% also say they are at the advanced planning and implementing stage of connectivity and/or Internet of Things.

"It depends on the industry, but I think most companies should be investing in and upgrading their technologies and processes," says Sheils. "In the medical devices industry, there are a lot of annual audit and inspections. This means digital records are vital and vision systems are quite important to detect any defects and to ensure quality. We have high levels of connectivity with our cloud computing. These new technologies have been integral to the business over the last 15 to 20 years with the pace of improvement increasing and the cost of implementation decreasing annually.

Automation

Half of companies say that they are implementing automation, with 81% of companies specifying this as an important part of manufacturing. These types of automation include 3D printing machines on-site which are used heavily in engineering for instance, for prototyping and for the use of machine designs. Another type of automation is augmented reality (AR) and virtual reality (VR), which 21% of companies have said they have plans to implement in the next one to three years.

"There are a lot of potential future benefits in training people in terms of augmented reality. And we have a couple of pilot programmes at the moment, one with an industrial partner, and with one with a local college. These definitely have a potential future to help build proficiency in a safe learning environment before people are brought onto production lines.

"For those businesses considering investing in new technologies, I think they should benchmark as many companies as they can, and learn from the practical examples of the technologies actually working in a production environment. Start small and do a pilot, have a realistic plan and don't try to do too much - too fast. Collaboration between companies, universities, and organisations like Ibec are important for the future, as they can help with advice and assistance with the long-term impact of industry 4.0."

Start small: Venturing into smart manufacturing

Smart manufacturing technology being adopted and implemented into many discrete manufacturing businesses today certainly includes robotics, augmented reality (AR), smart machines and 3D printing. Yet these technologies alone don't create a smart or digital factory. Plant floor software such as manufacturing execution systems (MES) or manufacturing operations management (MOM)

"To be successful, a company must be driven to stay ahead in its industry, because being seen as a leader of technology will have a real benefit to future investment in the company."

– including work-in-progress, track and trace, maintenance, quality, and more – must evolve to support the digital factory as well.

“As a large-volume manufacturer, we have invested in collaborative robots – also referred to as ‘cobots’ – and automated guided vehicles (AGVs) to automate the material handling process,” says Cormac Ashe, Senior Director, Sales and Development Engineering at West Pharmaceutical Services, Inc. (“West”) Contract Manufacturing – a leading manufacturer of packaging components and delivery systems for injectable drugs and healthcare products, based near Mulhuddart in Dublin. “These technologies work alongside our staff and have helped significantly with customer demand. They assist with the control and protection of materials, the packaging of goods and the transfer of products to a warehouse.”

While the cobots and automated guided vehicles are relatively straightforward and are becoming less expensive, Ashe explains these technologies simply manage the process. So, for communication on progression of the process, the company integrated a manufacturing execution systems and an enterprise resource planning system.

“Enterprise resource planning creates and manages the basic schedule including order processing, while the manufacturing execution systems monitor, track and report the traceability of the product and the operations on the plant floor in real time. We find these systems to be a critical component of industry 4.0, as we can effectively manage our production activity and drive competitiveness into our product offering.”

Big data

Within the discrete manufacturing industry, the use of big data and advanced analytics can allow manufacturers to eliminate the risk from decision-making processes. Nearly one in three Ibec Medtech and Engineering member companies have either implemented or are at the advanced stage of implementing big/smart data and advanced analytics.

Ashe comments, “With the introduction of our MES system, we have started our journey with big data and analytics, gathering information and storing this in the cloud. We haven’t yet started to utilise that data to drive decision-making yet, but we have a team on-site here that is a part of our corporate IT team, and they are seeing the power of the MES system, in that it provides the operation with key information in a much more succinct form.

“Whereas before, it was machine-learning and taking the information directly from machines. Now, we can analyse key information, so that the decision-makers can say ‘this is where we need to look’.”

Many manufacturers have already found ways to accelerate improvement using forward-looking analytics approaches, but it is important to remember that incorporating new technologies is a process of continuous discovery.

“For companies thinking about investing in new technologies, start by exploring and experimenting with something small, such as a cobot or a virtual reality system, rather than jumping in and thinking the business should have everything at once,” says Ashe. “Then, you will start to see the opportunities of establishing applications and building on technologies which will help to achieve the company’s visions and goals.”

Focus on new technologies

Almost one in five of Ibec Medtech and Engineering member companies have planned to automate their existing processes for the next 1-3 years. These goals, and more like them, demand a clear focus on how integrating technologies accelerates manufacturing growth. Ashe, who also sits on the Irish Medtech Advanced Manufacturing Working Group, says it is vital to not just build a roadmap and desired outcomes, but to gain valuable insights through available supports that Ibec provides, such as training.

“There are courses being developed all around these new technologies, with great support from Ibec,” says Ashe. “While we still have future plans to automate some of our paper-based processes, we’ve been established as a flagship site for the level of technology and automation we have adopted across our sites. Executives and customers come through our doors, and when they see the technologies we are introducing, they are blown away.”

To be successful, Ashe advises that a company must “be driven to stay ahead in its industry, because being seen as a leader of technology will have a real benefit to future investment in the company.”

Talent

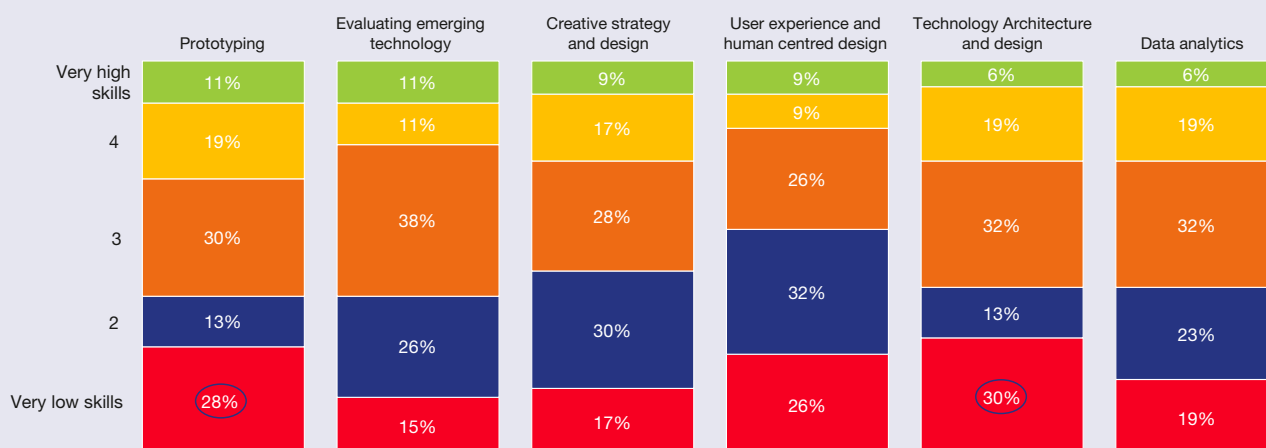
Access to talent and upskilling are vital for Ireland's manufacturing success according to Sanmina and Mergon. Ireland boasts a high number of worldclass third-level graduates, but changes are needed to reflect changing workplace and disruptive technologies. When

looking for top talent, manufacturers must reach out to diverse groups and different sectors. When you've assembled your team, personal development plans ensure your talent can keep pace with your growth by upskilling.

Rating of Organisation's Digital Skill's Capabilities

(Base: All member companies n=47)

How would you rate your organisation's digital skills in terms of its capabilities in the following areas...



○ ○ Significant difference @ 95% confidence level

Overall, the rating of digital skills in member companies is low with just 11% of members rating the level of skill held internally on any one aspect as "very high skills".



Sean Moran
Sanmina Ireland
VP of Operations and
Plant Manager

Why upskilling is needed to get the best out of smart factories

Industry 4.0 has significantly changed the world of work. It is improving automation and data exchange in manufacturing technologies and transforming production lines, supply chains and product portfolios. With the integration of industry 4.0, machines are becoming smarter and much more capable. As a result, employees too must acquire higher-level skills to keep pace with technology transformation happening in the manufacturing industry.

Based on research conducted by Ibec Medtech and Engineering, more than one in ten companies rate their digital skills as 'high' or 'very high'. These skills, from prototyping to evaluating emerging technologies, to technology design and data analytics, all help drive processes forward and enable progress.

Sean Moran, Vice President of Operations and Plant Manager for Sanmina Ireland in Fermoy, says industry 4.0 is driving improvements in upskilling, empowering employees to more effectively compete in the modern manufacturing industry. Sanmina, a technology leader and global supplier of complex medical systems that is celebrating its 30th year of operations in Fermoy, encourages its team to embrace continuous improvement and always be learning new skills.

"Upskilling is vital," says Moran. "You can locate all the equipment and resources you need, but having the right talent is critical to business success. Access to talent in Ireland, both from Irish employees and people overseas, has played a huge part in our success."

There are additional initiatives underway to improve digital skills through the Medtech Working Groups and Regional Skills Forums. Colleges are also more actively working together to develop industry-focussed programmes. Collaboration between the government and educational institutions has also been successful, through the Springboard+ courses. Skills developed through this programme have helped employees learn new capabilities that advance their careers in the industry. At Sanmina, we have benefited from team members completing the Springboard Automation & Control Systems in CIT (level 7 course).

Ireland has a high number of strong, third-level graduates. As the sector grows, developing that talent, at every level has remained a vital part of the industry. Ireland has more third-level graduates than the EU average and has world-class managerial talent. This means that many elements are already in place to help companies succeed.

Upskilling the current and future workforce is integral to the success of the manufacturing sector. Sean Moran comments, "We have a very strong further education support programme in place. We take initiatives to target certain training and skills developments outside the company eg the Advanced Manufacturing Engineering in CIT (level 8 course). We also provide staff with in-house training when it's a key business need. It's a continuous learning environment that is essential for businesses to compete and stay relevant. We have witnessed the benefits that our team has gained by participating in these focussed programs that have advanced their skills and capabilities."

The use of online tools and online training, more flexible modules for people who are in full-time work, and more modular structures could help with training the future workforce. Moran says, "In the past, people were required to participate in a two-year, full-time course, which was not always practical. Today, there is a more enhanced approach to the modularisation of key training aspects, so that employees can do a three or four-month course focussed on a particular area. This approach is certainly more suited to the industry and to a person's life commitments."

But there are more changes required in third-level institutions to reflect changes in work and technologies. Sean Moran says that while the third-level institutional approach does a lot of great work, there could be more emphasis on apprenticeships in the industry to create a more "hands-on" approach to learning.

"A key aspect of industry 4.0 is aligning digital skills with real machine knowledge, equipment knowledge and technology knowledge. All of these elements together enable really powerful progress, particularly in the manufacturing environment. The apprenticeship model has been reintroduced slowly, which is very constructive. There's a pool of talent that we haven't explored as we have moved away from the in-depth apprentice system. I think these are valuable pathways for people to realise their potential, enabling them to make a really constructive contribution to Ireland and to the industry."

Moran adds, "Technologies can come and go very quickly, so being involved in early stage design,



Joan Hyland
Mergon
Director of Innovation
and Excellence

creation, development and prototyping are essential employee skills. We need to improve training and accessibility for employees in order to facilitate continuous improvement that positively contributes to today's dynamic business environment."

Attracting and retaining top talent: Skills development is essential for growth

Every industry has been impacted by technology, ushering in the fourth industrial revolution, or industry 4.0. As it continues to be implemented, new production technologies (additive manufacturing, ro- and co-botics, virtual, augmented and mixed reality) will become commonly used. But with these digital technologies, comes the need for more digital capabilities in organisations. This will lead to demands to re-train and up-skill employees in order to secure and grow Ireland's manufacturing base.

Joan Hyland, Director of Innovation and Excellence for Mergon, says that being progressive when it comes to technology is a core element to ensure a company is a partner of choice. Mergon, an Irish-owned company which specialises in precision blow moulding, injection moulding, and assembly of technical components for the automotive, industrial, and medical industry, is a leading company in digitisation.

"The more you digitise the workplace, the more you have to support this innovation and digitisation," says Hyland. "You have to see what could be useful and what would actually make things better for the organisation. We have put a lot of effort into expanding our capabilities and developing our people so that they are capable. We utilise industry 4.0 to improve our process, but we've also modified and upgraded our current systems and equipment to enable us to extract the right information at the right time. This enables us to make better decisions and better interventions when needed."

According to Ibec Medtech and Engineering, digital skills such as prototyping; evaluating emerging technologies; creative strategy and design; user experience and human-centred design; technology architecture and design; and data analytics are all

important to industry 4.0. However, the skill level of these capabilities within organisations are not rated as very high. For example, prototyping skills are significant within the industry as it allows companies to predict the issues that will come up before they complete the design process. This saves time and money.

Technologies can come and go very quickly, so the ability to be able to be involved in early stage design, creation, development and prototyping are essential talents. 3D printers and virtual reality have become a priority in a lot of departments as they allow rapid prototyping when designing products. These skills are vital to have going forward.

Joan Hyland says companies are skilling up on a daily basis in key areas, "When hiring, we try to reach out to different groups and encourage current employees to upskill. We always have personal development plans for employees and for our management team through daily experience and training."

"For instance, with data analytics, we use real-time visual representations, so you don't need someone to input all the data manually anymore, it's all collated from the machine. This allows people to spend less time gathering data, and more time interpreting the data they see and make decisions based on that. It takes skill to interpret but with experience and training, it adds more value and saves time," Hyland adds.

All Ibec member companies claim that they have plans to invest in new equipment or technologies in the next three years, while 96% claim that they are planning on hiring more staff.

Hyland comments, "You need to have good graduates to ensure that you remain ahead in your capabilities in all areas such as design and development. Third-level colleges are extremely important to us as are apprenticeships. Mergon were key to developing and designing the polymer processing technology apprenticeship with Ibec's Polymer Technology Ireland and we had one of the first students here under that apprenticeship. It gives a very strong foundation and exposure to hands-on experience and the culture of the company.

"Ibec also helped a lot with the access to the industry network in Ireland and beyond. The conferences they run keep us ahead of the game as they explain what other people are doing in the world and what we need to be exposed to. We are in a much better position than we were a few years ago and I think that's true of many companies."

Ibec Medtech and Engineering member companies which participated in the survey

4Tech Cardio	NAMMO Ireland Ltd
Abbott	Nordson Medical
AbbVie, Ballytinnan	Optel
Alcon Ireland	OrthoXel
Allergan Pharmaceuticals	Phillips Medisize Sligo Limited
APS Materials Inc	Sanmina
Bausch + Lomb Ireland	Schivo Medical
Baxter Healthcare S.A.	Siemens Healthineers
Becton Dickinson	SmartFactory
Blueacre Technology	Specialised Sterile Environments Ltd
BOC Gases Ireland	Stryker
Boston Scientific	Synecco
Conductix-Wampfler Ltd	Thormac
DePuy Synthes	Transitions Optical
Harmac Medical Products	Trend Technologies Mullingar Ltd
Kingston Technology	Trinity Biotech
Litec Moulding	Vision Care (J&J)
Medtronic	Wellman International Limited
Merck Millipore Ltd	West Pharmaceuticals
Mergon	Zenith Adhesive Components

About Ibec

Ibec is Ireland's largest lobby group representing Irish business both domestically and internationally. Its membership is home grown, multinational, big and small, spanning every sector of the economy. Together they employ over 70% of the private sector workforce in Ireland. Ibec and its trade associations lobby

government, policy makers and other key stakeholders nationally and internationally to shape business conditions and drive economic growth. It has over 230 professional services staff in seven locations including Brussels and has 38 different trade associations in the group.



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