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# The Skills Needs of Manufacturing in the North West 2019

Skills Audit undertaken by the  
North West Regional Skills Forum  
in Collaboration with FIT



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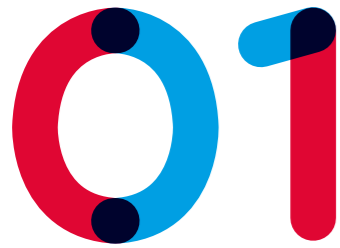
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## A Joint Initiative

This audit is a collaboration between the North West Regional Skills Forum (NWRSF) and FastTrack into Information Technology (FIT CLG).



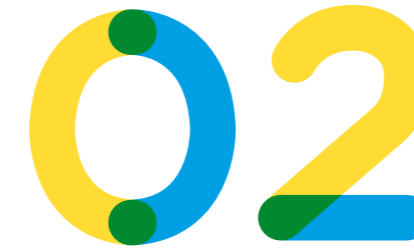
The North West Regional Skills Forum is one of nine Regional Skills Fora, which were established by Government as part of its National Skills Strategy to provide an opportunity for employers and the education and training system to work together to meet the emerging skills needs within the region. The region's Education and Training Boards (Donegal ETB and Mayo, Sligo and Leitrim ETB) and Higher Education Institutions (St. Angela's College, IT Sligo and Letterkenny Institute of Technology) along with employers and employer representative bodies and the Department of Employment Affairs and Social Protection are represented on the North West Regional Skills Forum. A major objective of the North West Regional Skills Forum is to determine the current and future needs of employers in relation to education, skills and recruitment. This will further inform local education and training providers when designing new programmes and reviewing existing programmes.

FastTrack into Information Technology is a not-for-profit, industry-led operation. Its core mission is to promote an inclusive Smart Economy by creating routes to marketable technical skills for people at risk in Ireland's labour market. It has pioneered its own methodology for working with employers to understand their skills needs through the granular analysis of the skills, knowledge and competencies required. Working in collaboration with QQI, SOLAS, ETBI/ETBS and other awarding bodies, it designs programmes that enable people to acquire the in-demand skills identified, assists local education and training providers to deliver them and supports those who complete the programmes to secure quality employment. FIT was recently appointed the Coordinator Provider for the national roll-out of ICT Apprenticeships in Network Engineering and Software Development (Level 6) on the National Framework of Qualifications (NFQ).

The objective of this manufacturing audit is to articulate and collate the talent requirement of manufacturing enterprises in the North West region, inform local education and training providers about the skills needs of employers in the various manufacturing related sectors, influence curriculum development to better reflect the needs of local industry, and to offer direction and insight to job seekers wishing to pursue careers in related sectors.

## Manufacturing Internationally and Nationally

The global manufacturing sector remains a critical force in both advanced and developing economies. The sector is undergoing significant changes bringing new opportunities and challenges to business leaders and policymakers.



Industry 4.0, the overarching name given to the next disruptive industrial revolution is driving much of the changes that are currently taking place in manufacturing. The Fourth Industrial Revolution (Industry 4.0) is quite different from the three Industrial Revolutions that preceded it - steam and water power, electricity and assembly lines, and computerisation - because it will even challenge our ideas about what it means to be human. All aspects of manufacturing organisations will be affected but it is particularly evident in high-specification and highly regulated industries like pharmaceutical manufacturing and medical device manufacturing. This in turn will lead to increased demands to upskill and reskill employees in new technologies and processes.

The key enabler for the digital transformation of manufacturing is the Industrial Internet of Things (IIoT) which connects the traditional analogue based automation infrastructure to the digital world. This will change the manufacturing industry in a variety of ways. Some examples include:

- Automated ordering of raw materials based not only on current demand levels, but predicted future demand.
- Improved product quality by linking customer feedback and real-time usage data to the product development process.
- Reducing factory downtime and product supply disruptions through predictive machine maintenance, where machine learning algorithms monitor machines to identify problems before a breakdown occurs and then plan maintenance at a time that will cause as little disruption to supply as possible.
- Allowing support engineers to be in the same room as a technician in another factory in another country, helping them resolve an issue using virtual and augmented reality.
- Production processes that don't require a mass manufacturing approach to remain profitable but can, instead, run efficiently in small production runs - theoretically, down to production runs of one.

No country is immune from digitisation. As industries shift to more advanced, automated processes, employers need additional people – especially those with IT skills – to drive transformation.

**From an Irish perspective, with over 4,000 manufacturing employers operating throughout Ireland, directly employing over 200,000 employees collectively.**

Manufacturing plays a critical role in the economy as a driver of exports, as an employer, as a source of revenue and as a key driver of growth. The manufacturing sector also has significant spin-off effects to other sectors including services, logistics, mining/quarrying, agriculture and sub supply.

Manufacturing in Ireland has undergone significant change over the last 15-20 years due to shifting global demands for goods and increasing competition from emerging countries which have competitive advantages due to cheaper labour. To counteract this transition, employers have focused on high-tech areas such as ICT, medical devices and pharmaceuticals. This shift has been accompanied by investment into new ways of working through leaner business and production processes enabled by technologies.

The impact of digital technologies will have both positive and negative consequences for the manufacturing sector. 3D printing, for example, allows manufacturers to prototype items faster than before and with less investment. Investments by organisations into 3D printing means that many enterprises could soon start to print much of what they need rather than ordering it from manufacturers. Many Irish manufacturing organisations already have a higher than average level of automation and robotics than are found in other sectors (Expert Group on Future Needs Skills, 2018 Digital Transformation Report). Further automation will no doubt have an impact on the sector, but the impact will be lower than if the sector was at a less mature stage. In fact, further investment could make the sector more competitive in comparison to other EU countries.

The combined effect of these will lead to many occupations being at risk. A recent report by the Expert Group on Future Skills Needs (Digital Transformation: Assessing the Impact of Digitalisation on Ireland's Workforce, 2018), estimates that 21% of occupations are at high risk, with a further 65% at medium risk. Occupations associated with processing and operations are at risk, especially those associated with manual work, such as packing and filling machine operatives. Much of the disruption, however, will result in changes to job roles and tasks performed by individuals rather than job losses.

## Manufacturing in the North West: A Profile



**In accordance with the brief, research was conducted on the profile of manufacturing specifically in the North West.**

**Quantitative information was obtained via analysis of principally the most-recent CSO data on the border region as a whole (North West and North East). However, more revealing information on the region was obtained through document analysis<sup>1</sup> in such a way that empirical knowledge was produced and understanding developed.**

Collectively, the findings point to a rich diversity in manufacturing operations within the North West with a different range of operations matching themselves to equally different types of location. Analysing any aspect of the North West's economy has to reckon with the fact that labour market data is primarily gathered for the Border Region as a whole without distinguishing between its North West and North East<sup>2</sup> parameters. Overall, the share of manufacturing in the Border Region's total employment is in keeping with the national average (11.5% as against 11.3%) but its composition is markedly different (Table 1).

Border Region manufacturing is more concentrated in subsectors classified as 'low-technology' (52% as against 38% nationally) and less concentrated in subsectors classified as 'high tech' or 'medium-high tech' (26% as against 46% nationally). In addition, the size structure of enterprises in the region is more skewed towards micro-enterprises (those with fewer than 10 people at work) and against large enterprises (250+) than is typical nationally.

Many of the world's largest multinational MedTech companies have facilities in the North West. Some even have more than one. There are also indigenous Irish MedTech manufacturers and innovators in the North West, plus there is a large number of local companies providing specialist support services across Ireland to both multinational corporations and indigenous organisations.

**Table 1: The Structure of Manufacturing in the Border Region and State—Selected Features, 2016<sup>3</sup>**

	Border	State
<b>Share of Total Employment in Manufacturing</b>	<b>11.5%</b>	<b>11.3%</b>
<b>Manufacturing employment by technological intensity (Q4 2015)<sup>1</sup></b>		
% low-tech	52%	38%
% medium-low	22%	16%
% medium-high	13%	18%
% high-tech	13%	28%
<b>Share of total employment in micro-enterprises (&lt;10 persons)</b>	<b>39%</b>	<b>28%</b>
<b>Share of total employment in large enterprises (250+ persons)</b>	<b>11%</b>	<b>31%</b>

Sources: Regional Labour Markets Bulletin 2016, SOLASEGFSN (2016); CSO (2016).

<sup>1</sup> Based on reports from IDA Ireland and Enterprise Ireland; the North West's Regional Action Plan for Jobs and updates; Project Ireland 2040; the Local Economic and Community Plans of the three counties concerned; Donegal's joint initiative with its Derry and Strabane counterparts in Northern Ireland; the local business press and company websites.

<sup>2</sup> Censuses are the great exception; they enable a detailed picture of the NW to emerge from their copious data on each of its three counties but relying on Censuses means changes can only be looked for at five-yearly intervals

<sup>3</sup> High technology: pharmaceuticals, computers, etc. (NACE 21-26); Medium-high: chemicals, electrical equipment, machinery, medical instruments, etc. (NACE 20, 27-30); Medium-low: petroleum products, rubber and plastic, other non-metallic mineral products, fabricated metal products etc. (NACE 19,22-25,33); Low technology: food, beverages, textiles, leather, wood, paper, printing, etc. (NACE 10-18,31,32).

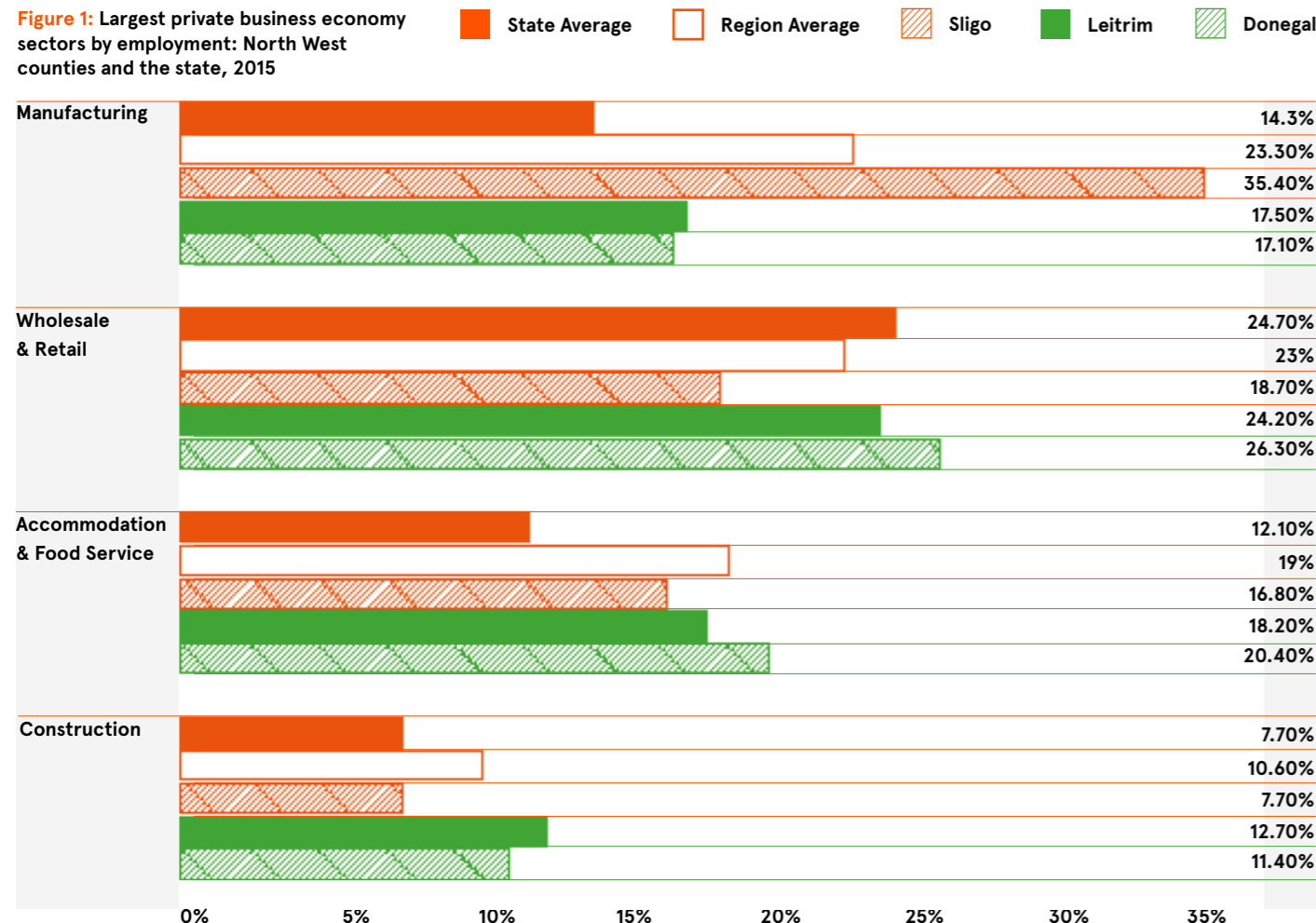
## Profile of the counties

This section is informed by a recent publication by the Western Development Commission – Industry in the Western Region (2019).

Such data may lead one to expect that much of the manufacturing in the North West consists of low margin businesses, mostly small but some large, where many at work perform relatively routine tasks requiring modest skill sets. This Audit, as we will see, finds evidence of some plants like this but, overall, points to a scale of sophistication that the term 'low-tech' (and 'traditional') does much more to conceal than reveal.

Greater clarity in seeking to understand the manufacturing currently being undertaken in the North West is provided from the CSO's Business Demography data set. This data covers what is termed the 'private business economy' and, importantly, is available on a county basis<sup>4</sup>. It usefully illustrates important differences between the counties of the North West as well between the sub-region and the State as a whole (Figure 1).

Figure 1: Largest private business economy sectors by employment: North West counties and the state, 2015



<sup>4</sup>The data come from Revenue's records of who is in employment. The private business economy excludes employment in agriculture, forestry and fishing, public administration, education, health and social work – in the most recent Quarterly Labour Force Survey (Q2 2018) over one third (35%) of total employment

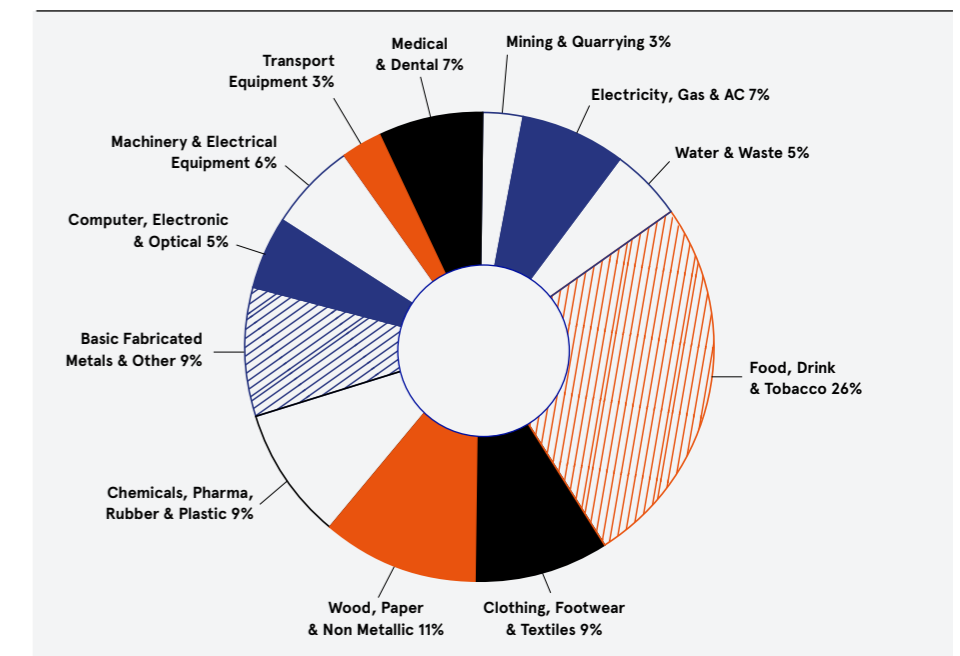


## Donegal

Over a quarter of industrial employment in Donegal is in Agri-food. It is quite dominant in the county's current industrial composition and Donegal has the region's highest share of industrial employment in Agri-food employment. Within Agri-food, seafood processing (507 people) is by far the largest element. Four other sectors account for 9% or more of industrial employment. While Clothing, Footwear & Textiles experienced massive declines in the county over the past two decades, it still accounts for 9% of industrial employment (516 people). The share working in Clothing, Footwear & Textiles is far higher than any other county in Ireland (national average is 2%). The continuing strength and international reputation of Donegal tweed is a core element of the sector.

Unlike other western counties, the MedTech sector is relatively small accounting for 7% of industrial employment. This figure is expected to increase significantly as a result of Abbott in July 2018 announcing 500 new jobs for Donegal. At 7% of industrial employment, Donegal has the region's highest share working in Energy influenced by Donegal's considerable wind energy sector and Lough Erne Hydro Station.

Figure 2. Percentage of total industry employment in each sub-sector in Donegal, 2016



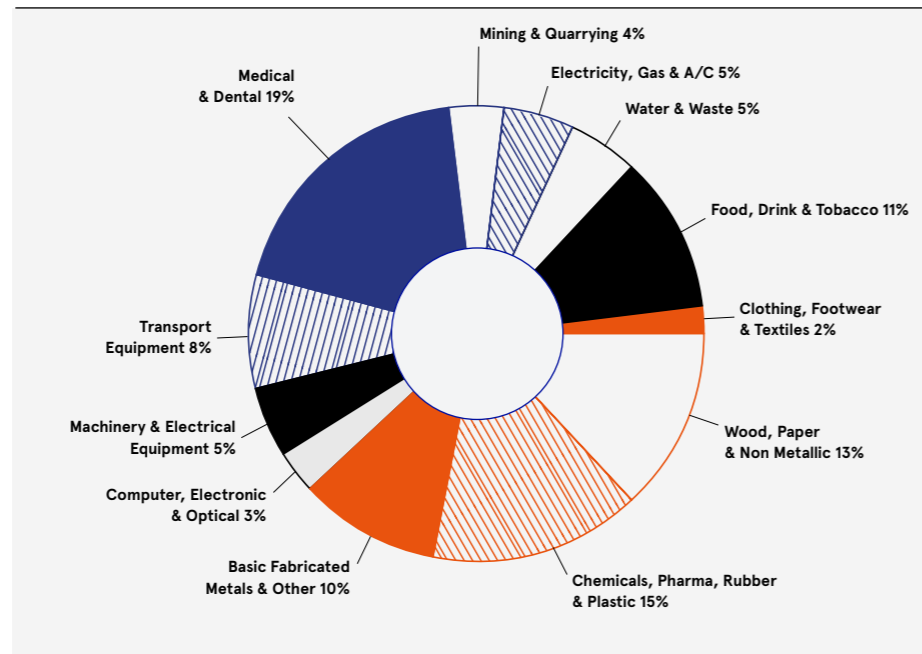
Source: CSO, Census 2016: Summary Results Part 2, Table EZ011

### Leitrim

The largest industrial employer for residents of Leitrim is MedTech with 19% engaged in this sector. The next largest is also in high-tech manufacturing, Chemicals, Pharma Rubber and Plastics, and these two sectors jointly account for a third of all industrial employment in Leitrim. The more traditional Wood, Paper, Printing & Non-Metallic (13%) is the next largest with the county having the highest share working in this sub-sector in the Western Region. This is followed by Agri-food (11%) which accounts for a relatively large proportion of industrial employment in the county. Leitrim has a high share of industrial employment engaged in Metals & Other (10%).

At 8%, the Transport Equipment sector accounts for a higher share of total industrial employment in Leitrim than any other county in Ireland. This would include Mirror Controls International, based in Manorhamilton, which manufactures mirror parts for the automotive business. Between 2011 and 2016, total Industry employment among residents of county Leitrim grew by 21.1%, more than double the national increase and the highest growth among all western counties. The county experienced growth of 80.4% (+127 people) in MedTech, with both Computer & Electronic (51.6%, +16 people) and Metals & Other (42.1%, +45 people) also having strong percentage growth. Leitrim only experienced a decline in employment in two sectors – Mining & Quarrying (24.7%, -19 people) and Waste & Water (16.3%, -13 people) – but saw growth of 20% in the other non-manufacturing industrial sector of Energy (+12 people).

Figure 3. Percentage of total industry employment in each sub-sector in Leitrim, 2016



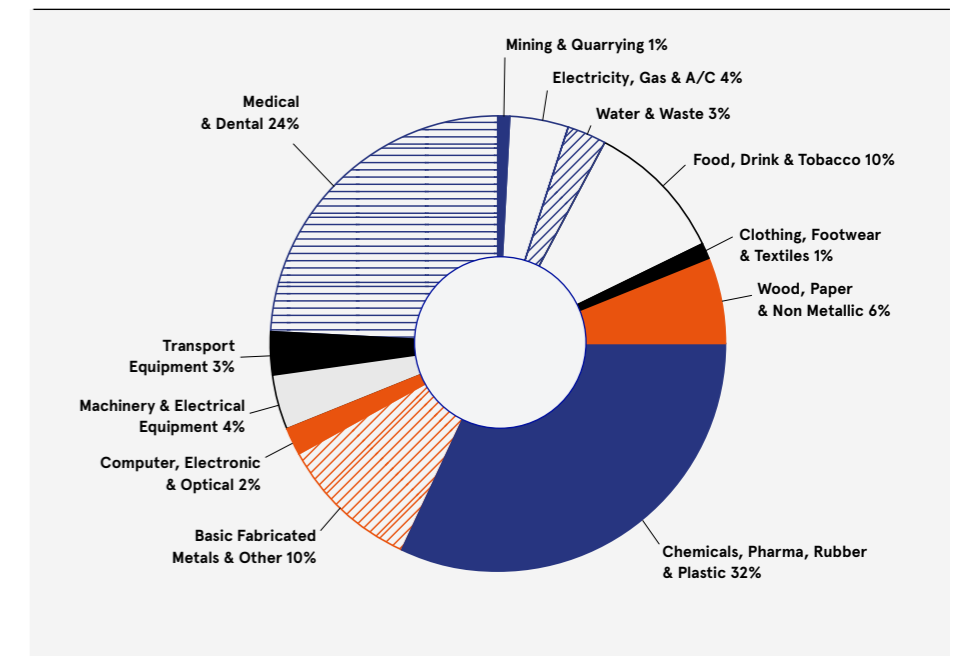
Source: CSO, Census 2016: Summary Results Part 2, Table EZ011

### Sligo

Manufacturing of Chemicals, Pharma, Rubbers & Plastics is by far the largest industrial employer in Sligo, accounting for almost 1 in 3 industrial workers. Within this, pharmaceutical products is the largest activity. The share of industrial employment accounted for by Chemicals, Pharma, Rubbers & Plastics in Sligo is second highest in the country (after Waterford) and considerably greater than the national average (18%). At 24%, Sligo has the third highest share of industrial employment in MedTech in the state, surpassed only by Galway City and County. After these two high-tech manufacturing sub-sectors, the next largest are Agri-food and Metals & Other, both accounting for 10% of industrial employment.

Between 2011 and 2016, total industry employment among residents of Sligo only grew marginally (0.3%), considerably lower than the national increase of 9.4% and the Western Region average of 13.7%. Four industrial sub-sectors showed jobs growth among residents of Sligo between 2011 and 2016. Metals & Other (26.8%, +72 people) and Transport Equipment (25.8%, +17 people) had the strongest growth, with 8.6% growth in the large MedTech sector (+63 people). However there were declines in the numbers working in most industrial sub-sectors, Mining & Quarrying (22%, -9 people), Water & Waste (21.9%, -23 people) and Wood, Paper, Printing & Non-Metallic (15.2%, -33 people) had the largest percentage decreases.

Figure 4. Percentage of total industry employment in each sub-sector in Sligo, 2016



Source: CSO, Census 2016: Summary Results Part 2, Table EZ011



## Manufacturing Operations: The Context

The range of manufacturing operations being carried out in the North West varies from advanced manufacturing based in larger urban areas to more stand-alone operations in rural locations. In each case, large and small, foreign and indigenous enterprises can be found.



### Advanced Manufacturing

At the heart of advanced manufacturing is the ability to identify and adopt tech improvements; source top-class sub-suppliers; access to international markets and attract top-talent – key elements for which the North West is well equipped to boast.

Such success in the region can be attributed to the presence of a concentration of similar companies creating an eco-system of specialised hubs, supported by technical sub-suppliers collectively acting as a magnet for highly-skilled staff and a stimulant for R&D. Furthermore, the region boasts a strong sense of connectedness that nurtures thought-leadership. This escalates the attractiveness of the region internationally, particularly if the manufacturing plant is integrated into a multinational's global supply chain, which in turn can be a catalyst for the recruitment of young indigenous talent.

**Advanced Manufacturing Case Study: Using Data Science and Machine Learning to determine excessive energy consumption in a batch manufacturing process.**

This case study sets out the pragmatic use of advanced manufacturing methods to automate and improve a manual procedure in a manufacturing company.

Batch manufacturing processes are extremely energy intensive. IT Sligo and the PEM Research Centre are using data science and machine learning to identify batch processes that consume significantly greater energy than other identical processes.

To begin we analysed approximately 1000 manually recorded manufacturing records that were documented over a one year period. These were digitised and transformed into a useable format for analysis. The duration and time of each processing step were calculated for every batch and product. Using statistical analytical methods, we were able to identify outliers that represented the batch processes consuming significantly more energy than necessary.

Having developed the necessary statistical tools our client is now able to use our software package for the real-time prediction of a highly variable manufacturing process. Incorporating sensor technology for the gathering of manufacturing data, as opposed to manual recording, will allow for rapid identification of manufacturing issues. This will greatly increase productivity for our client and ultimately reduce production costs.

### The Challenge of Urban Scale

Ensuring national economic development to 2040 is sustainable and more regionally balanced,<sup>5</sup> Project Ireland 2040 underlines how 'two key variables' affect a region's economic development prospects. They are (i) the scale of concentration of economic activity it offers, and (ii) the relative distance, or ease of accessibility, it has to larger centres of population and employment, i.e. to 'centres of scale'. We live, it notes, 'in an era when the nature of urban places is a critical factor in determining economic growth and regional development' (p 56).

The formation and final shape of Project Ireland 2040 was strongly influenced by the realisation that all of the State's six largest urban conurbations lie south of a line drawn from Galway to Dublin, and that the North West's two largest urban areas each have a population of only around 20,000. However, the region in reality is punching way above its weight as a result of its pattern of specialisation. Ireland is amongst the highest for its share of manufacturing value-added in the OECD<sup>6</sup> owing largely to its share in the high-tech manufacturing landscape; a landscape for which the North West is renowned.

In Letterkenny, Donegal County Council and Derry City and Strabane District Council areas have joined forces to promote Letterkenny-Derry as linked gateways to the North West and to drive the economic development of what is presented as, in effect, a cross border City-Region (Gateway to Growth, 2017)<sup>7</sup>. With Derry and its urban population in excess of 100,000 as its core, the full regional population, when Letterkenny and its environs are included, is of 350-400,000 people making it 'the fourth largest urban agglomeration on the island of Ireland'. While pointing primarily to the presence and further potential of advanced services activities, their strategy cites the presence of 245 companies in Advanced Manufacturing and Engineering in the region with specialist expertise in Automation Technology, Agricultural Machinery, Quarry/Mining Machinery, Materials Handling, Print & Packaging, Mechanical Engineering, Electrical Engineering, and Precision Engineering & Fabrication.

<sup>5</sup> Project Ireland 2040 commits to 'effective regional development', i.e. ensuring greater autonomy and support to allow each region play a greater role in identifying and developing its unique resources and assets. For this, a new institutional architecture is now in place – the three new large regions that replaced the previous eight, the enhanced responsibilities of local authorities for economic development, the regional skills fora, regional alliances among higher education institutions, etc.).

<sup>6</sup> Economic Outlook, OECD, 2018.

<sup>7</sup> Gateway to Growth: North West Economic Development Initiative, 2017.

In Sligo, inward investors have chosen to automate rather than relocate previously labour-intensive operations, to undertake successive expansions (one operation has been expanded eight times since its establishment in 1994) and even to manage from Sligo labour intensive operations that are now more economical to carry out overseas. The CEO of a New York-based software company LiveTiles in choosing it as a location in 2018 described Sligo as having 'an up-and-coming technology scene'<sup>8</sup>.

In Leitrim the number of manufacturing companies choosing the county for their operations is growing with an increased presence in export-orientated companies catering for the medical technology sector. This is reflected in the county's economic strategy which predicts larger shares of employment in manufacturing by 2021 compared with the baseline of 2011 percentages.

In seeking to grow and attract more advanced manufacturing in the North West, the increasingly blurred boundaries between advanced manufacturing and services should be noted. Advanced manufacturing frequently bundles the provision of services to customers along with sales of its products. Furthermore, the operations of advanced manufacturing plants frequently entail buying-in multiple specialist services from service providers.

Sligo, Letterkenny and Carrick-on-Shannon are alive to the opportunities that being small in the national context can provide. These locations are well positioned to leverage the high-cost, over-crowded status of the country's cities to attract top-tier talent to the region. These opportunities may present themselves in several forms; choosing to live in the area while retaining their principal source of employment in a major city ('de-commuting' or remote working), finding a local employer or working independently as consultants or through small company start-ups.

Finally, the payroll generated by manufacturing operations can be major sources of revenue for downstream local services (retail, accommodation, child care, activity pursuits, etc.).

## Traditional Manufacturing in the North West

In addition to advanced manufacturing, manufacturing that is labour intensive and relatively low skilled is present in the North West, and sometimes on a very large scale where plants draw workers from wide catchment areas and have a major local impact. These plants are relatively stand-alone once good transport links are assured and can function effectively in smaller towns and rural areas.

The challenges posed to manufacturing plants that rely heavily on the exercise of routine tasks by large proportions of their workforce are well documented and discussed in several key reports produced on the future of manufacturing in Ireland's economy (as the country at large becomes more of high cost operating environment for such plants), particularly sectoral reports from the EGFSN on, e.g., Food & Beverages, Transport, Logistics & Communications, etc. These reports make clear, the challenges facing manufacturing organisations to embrace automation and anticipate the contribution to productivity of digitisation and artificial intelligence (AI) are especially acute for indigenous manufacturing and make particular demands on employee skills training in particular. Frequently, small cadres of highly skilled but flexible and multitasked workers supervise and direct the work of much larger numbers of workers doing more routine tasks. It is widely acknowledged that even resilient and mature manufacturing companies in the region with strong traditions must move up the value chain by embracing automation and concentrating on higher level activities if the sector is to remain important in the region.

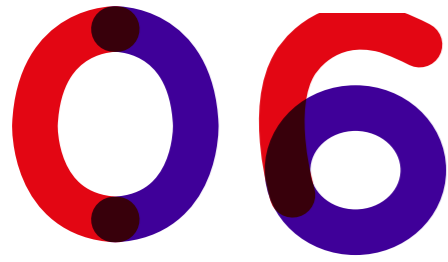
## Small Scale Manufacturing in Rural and Coastal Areas

Each county contains examples of micro and small rural enterprises that are engaged in manufacturing related to a specific feature of their locality's natural environment, tourism offering, culture or history.

Artisan food and drinks producers (e.g., Drumshanbo's Gunpowder Gin in Leitrim) and marine-based products are good examples but a wide range of craft products, home furnishings and other products also feature. In rural locations, their impact can be significant and in large numbers they are a significant feature of the North West's economy. Access to high-speed broadband hugely widens the markets into which they can sell thus making concepts of remoteness or small 'domestic' product demand largely irrelevant.

## The Companies Interviewed: A Profile

## This study is based on interviews with senior personnel in 26 manufacturing locations across the North West



The 26 companies interviewed represent the wide diversity of the region's manufacturing sector. The study includes routine, labour intensive operations and those that are highly automated; operations that need high-skills and the exercise of considerable autonomy and those that require low-skills and extreme diligence; micro scale plants (e.g., 10 workers or less) and very large ones (e.g., 750); products as different as knitwear and artisan food, on the one hand, and advanced pharmaceuticals and precision engineering, on the other; small and large indigenous companies, plants of multinational corporations that are highly automated and those that are labour intensive. The companies interviewed also illustrate the very different types of locations within the region to which manufacturers have matched themselves, from the Donegal Gaeltacht to the Sligo regional gateway, and from the Inishowen Peninsula to the banks of the Shannon.

The 26 manufacturing locations included in this study can be considered illustrative and a good cross section of what constitutes the region's manufacturing sector. A total of 3,137 people were at work across the 26 locations. Six had more than 200 at work, while 15 had 50 or less. The single largest location had 750 and the smallest 9.

Ten of the locations are in or near one of the region's two largest urban areas, Sligo or Letterkenny, eight are on or near Donegal's long Atlantic coastline, two are in Leitrim's largest town (Carrick-on-Shannon) and the remainder (6) are in smaller rural towns with all three counties represented.

Eight of the locations studied are engaged in one type or another of medical manufacturing and, therefore, part of what is, by far, the North West's most significant manufacturing cluster; five are engaged in engineering while the remaining locations are spread across eight different manufacturing sub-sectors.

Table 2: Activities of companies interviewed

Medical Devices	Engineering	Additional Manufacturing Sectors
9	5	2 each: textiles/clothing; food; metal fabrication; packaging (=8)  1 each: exhaust systems; hydraulic cylinders; elastomer mouldings/seals; construction hardware supplies (= 4)

## Manufacturing in the North West: Looking Forward

Following the introduction of the Local Government Act 2014, each Local Authority has embraced its heightened responsibility for economic development at both county and regional levels. The implementation of both the County Development Plans (CPDs) and Local Economic and Community Plans (LECPs) will make a significant contribution to the support of existing enterprises and the attraction of newer ones. The three counties, as well as sharing common features, have opportunities for economic development that differ from one another. Featured in the LCEPs is an analysis of each county's strengths and their commitment to reinforcing them for the purpose of economic development.

A key common dominator is the counties' objective to enhance the potential for economic development in the Service, Manufacturing and ICT Sectors through a combination of building on the success of existing enterprises and the growth of new ones. It is widely acknowledged that despite a resilient and mature manufacturing sector with strong traditions, the North West must adapt accordingly as a result of emerging growth and technological advancements, sharing in IBEC's vision for Ireland to become a world leader in manufacturing technology, operational excellence and cross sector collaboration (IBEC, 2016)<sup>9</sup>.

Furthermore, the abundance of quality manufacturing and industrial space, at prices that challenge any city in Western Europe, well positions the region as an incredibly competitive cost location (Gateway to Growth, 2017)<sup>10</sup>. This is emphasised in individual area plans that state the safeguarding of land which has been identified for employment purposes, in particular, sites for the purpose of high technology, research and manufacturing. Additionally, there is an awareness of the need to continue facilitating the development of a number of clusters in order to achieve their goals. While the opportunities are plentiful, there is recognition for the challenges being faced by the region. Firstly, large dependence on public sector employment is no longer sustainable thus building on their strong inward investment is a must. Secondly, while manufacturing continues to be one of the most common qualifications in the region, there is a lack of specialised skilled staff e.g. specialised toolmakers, process engineers, advanced manufacturing maintenance technicians and experienced software programmers owing mainly to the strong performance of the high-tech manufacturing sector<sup>11</sup>.

<sup>9</sup> Manufacturing a Renaissance, IBEC, 2016.

<sup>10</sup> Gateway to Growth, North West Economic Development Initiative, 2017.

<sup>11</sup> Growth observed in high-tech manufacturing at almost 7,000 persons employed nationwide (National Skills Bulletin, 2017)

## 4.0 Driving the Future of Industry

**The Internet of Things (IoT) is defined by the UN's global agency for information and communication as 'a global infrastructure enabling advanced services by interconnecting things based on existing and evolving technologies' – succinctly, systems/equipment/plant machinery virtually communicating continuously via ubiquitous wireless technologies.**

Industry 4.0 or the Industrial Internet of Things (IIoT) is often depicted as the 'Fourth Industrial Revolution', or the 'factory of the future' – encapsulating how businesses – particularly those involved in advanced production and logistics – exploit IIoT technologies to enhance the manufacturing, transportation and marketing processes thereby minimising costs while increasing efficiencies and productivity. Research by Oxford Economics suggests that these emerging technologies now impact 62% of the G20's GDP, alluding to a seismic shift in the industrial sector globally over the next 10 years with the wider adoption of IIoT's.

Manufacturers wishing to remain in the game need to embrace the digital transformation trends driving Industry 4.0. Technologies including advanced analytics, machine learning, and cloud computing and human-machine interfaces are part of the mix – leading to a technological reformation of our factories and manufacturing processes. No longer do manufacturers have to be large to take advantage of smart tools.

Perhaps the biggest facet of this industrial revolution will be changing relationship and dynamic between producers of goods and services and their customers. IIoTs put consumers in the driving seat, providing them with the means to readily articulate their requirements, expectations and preferences to producers in real-time. No longer is it a case of 'you can have any colour car, as long as it's black' (Ford Model T) – auto manufacturers today are able to offer an abundance of customizable options, even on entry level vehicles. Before customizing a million products for a million consumers was impractical and cost prohibitive – now, it is just as efficient to produce customized products as it is to produce batches.

In addition to engaging consumers in manufacturing process "smart factories" stimulate innovation, creativity and efficiencies through enabling connected employees get ready access to the 'live' data they need to refine business processes and set priorities. New collaborative platforms allow for the ready engagement of worldwide talent in building solutions.

Rapid advancements ERP, CRM and Customer Experience Mapping technologies enable employees observe the entire supply chain thereby informing decisions such as preferred products lines, impactful marketing strategies etc. Cloud analytics devices such as sensors enable businesses to realise efficiencies in production processes and logistics. Other tech such as Augmented Reality (AR) and Virtual Reality (VR) can also change the way products are designed by engaging end-users in the design process.

When we think about the future of work in the manufacturing sector, the threat of automation is a constant. However, the use of robotics is for the enchantment of productivity and offers people the opportunity to focus on creativity and innovation. In preparing the future labour force for the digital transformation, the combination of skills being acquired is vital. Breaking the mould on the idea that a 'job is for life' is central to developing an adaptable and collaborative workforce for which lifelong learning is a must. Digital transformation is now a critical factor for all enterprises but in particular for those involved in manufacturing sectors – accordingly Industry 4.0 is the critical path to future success. To ignore this reality is to wither on the evolutionary vine.

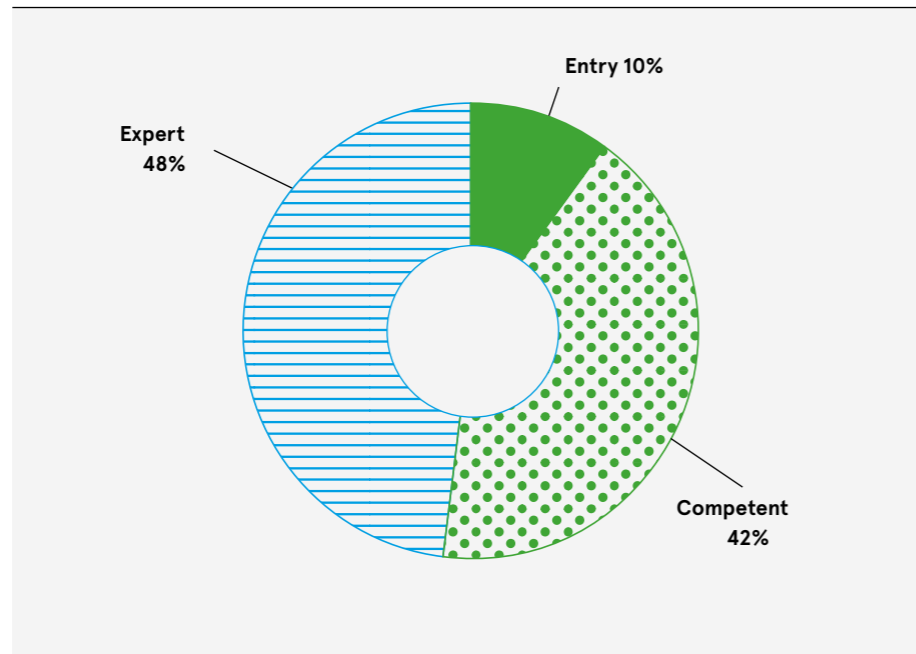
**Manufacturing in the North West has evolved from its heritage in precision engineering to now embrace advanced technologies that progress medical devices, pharmaceuticals and automotive components (Action Plan for Jobs, 2017).**



While the North West and North East are often combined for the purpose of analysis i.e. Profile of the Border Region (SLMRU, 2014), they differ greatly with regards to their manufacturing landscape.

This skills audit revealed that there was demand at all levels in all disciplines, the majority of which is accounted for by a combination of entry and competent roles. While the demand for experts was 48% (Figure 5).

Figure 5. Levels at which skills are being exercised and required



However the definition of 'expert' in relation to the manufacturing sector merits further exploration; firstly an expert may possess deep mastery in an area of specification such as precision engineering; mechanical engineering and a demonstrated aptitude for advanced analytics. Secondly, an expert can be defined as an individual who has gained solid knowledge through honing and deepening a skillset through practical experience. In today's manufacturing climate an expert who has gained extensive work experience is well positioned to undertake roles such as production team lead, project management or general management. Such responsibilities require a combination of both hard and soft skills in a real-world environment with an aptitude for project management and problem solving.

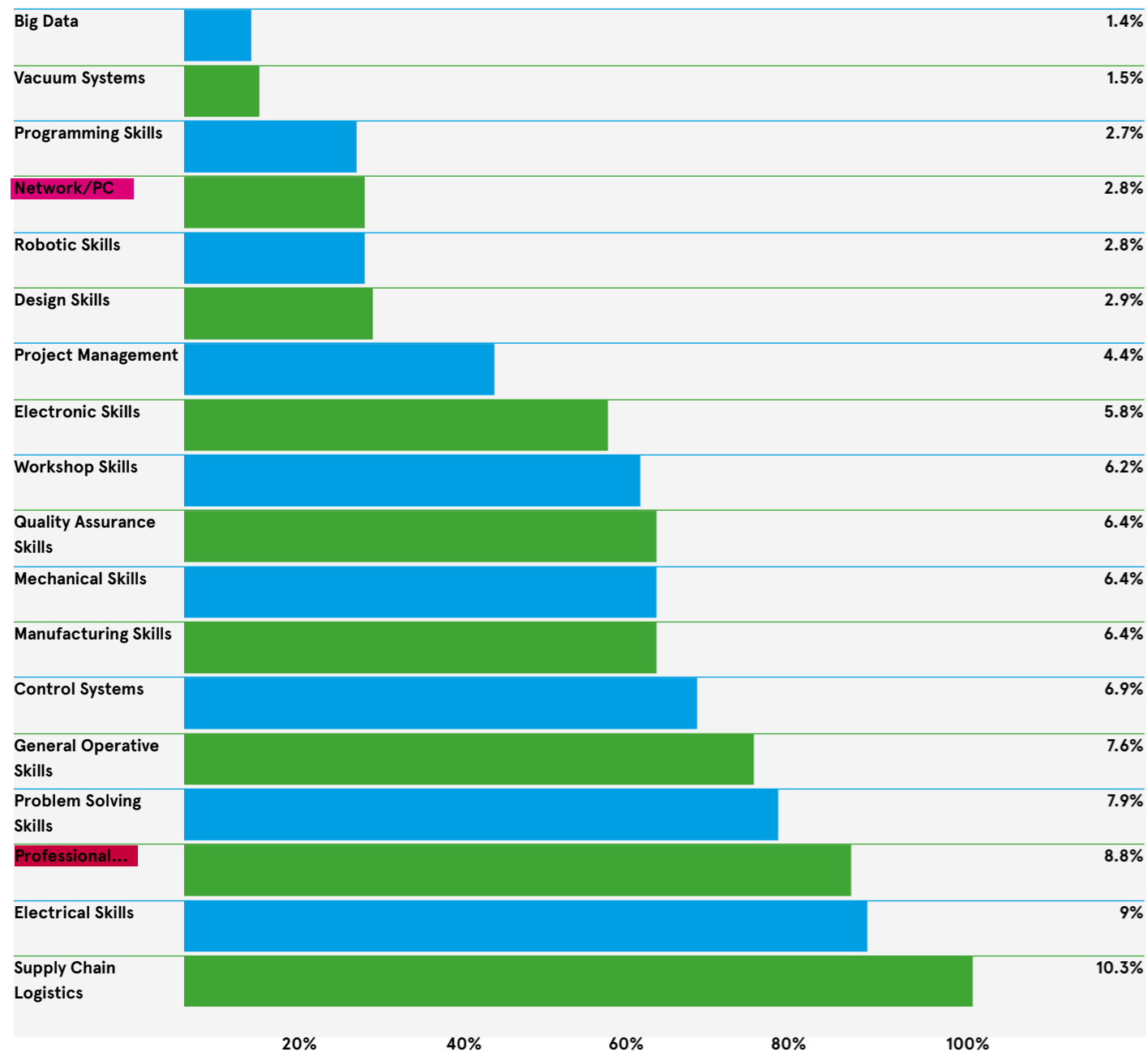
Demand at competent and entry level is being driven by the need for those in possession of technical and digital competencies required for high-tech automated manufacturing. Despite a talent pool of operatives available for employment, training in traditional operative skills is lacking the technical and digital elements needed to refine such roles for today's climate. The opportunity to satisfy vacancies at entry and competent level can be seized via the extensive range of FET courses including traineeships and apprenticeships. FET as a form of vocational education has a key economic function in up-skilling and providing high-quality technical skills to the labour market.

**The Demand for More Skills and/or Upskilling**

The skills required for the manufacturing sector in the North West have been clearly articulated by participating employers and are shown in descending level of demand in Figure 6. Participants were probed on the level of demand for entry, competent and expert roles in each of disciplines for which the accumulation is illustrated overleaf. Demand for entry, competent and expert levels is most evident in the supply chain logistics (10.3%) discipline with big data requiring the least (1.4%). The desire for upskilling is strongly supported by government policy and targets for employee development are set out in its recent publication<sup>12</sup>.

<sup>12</sup> Supporting working lives and enterprise growth in Ireland: 2018-2021 further education and training policy framework for skills development of people in employment. September 2018

Figure 6. Estimate of additional skills needed in the next 12 months



## The range of skills in demand by the manufacturing sector in the North West is diverse and spans from transversal competencies and traditional labour-intensive manufacturing to advanced manufacturing 4.0.

Increasingly the skill of problem solving is seen as a key requirement across all aspects of the sector. This is demonstrated by ongoing cross-pollination of skills required for the region's rapidly evolving manufacturing industry suggesting that an over-reliance on one particular skill does not exist and that it is, in fact, a portfolio of skills that are needed for a career in the sector. However, this greater need for a diverse range of skills is an opportunity for progression within enterprises, and a reminder to the significant number (52%) needed at entry and competent level what they can ambition by way of career paths (Figure 5).

A key requirement articulated in the skills audit was for skills in supply chain logistics in particular inventory planning and inventory management followed by make/buy decision making, cost modelling and metrics/ measures/standards.

**In response to this demand which spans entry through to expert level a number of approaches could be considered:**

1. To meet the needs at entry level, an Apprenticeship in Supply Chain Logistics could be developed. In addition to attracting new entrants such an initiative could target applicants already employed where their employers wished them to undertake some form of upskilling where enterprises needed to grow their related workforce. An apprenticeship called the Logistics Associate apprenticeship at Level 6 (Higher Certificate) was initiated by the Freight Transport Association Ireland in 2018.

It is a two-year programme delivered by DIT which comprises four days per week on-the-job, and one day per week off-the-job in college. This could inform an apprenticeship solution, however its structure and content should align with the skill needs of employers in the North West.

2. A short training programme could be developed to meet the skill needs at expert level which would involve existing experienced employees who have a desire to upskill. The programme would encompass best practice in Supply Chain Logistics and could be delivered as a short block (e.g. 4 days) or spaced out over eight half days.
3. 1 Year top up (Level 8 or Level 9 Programme) to build on what learners have already acquired. This proposed work-based learning programme could be delivered using a blended approach combining block classroom workshops, independent, online and workplace learning.

## The findings also reflected strong demand for manufacturing skills across a range of intermediate level technical areas.

These include electrical, control systems, manufacturing, mechanical, workshop and electronic skills. Transversal skill needs relevant to these areas were also prioritised such as QA, problem solving and project management. Such cross-disciplinary skills are increasingly being viewed as an essential prerequisite for an increasing number of manufacturing technician type roles. Considering this feedback from employers, training solutions could possibly address two cohorts of employees as follows:

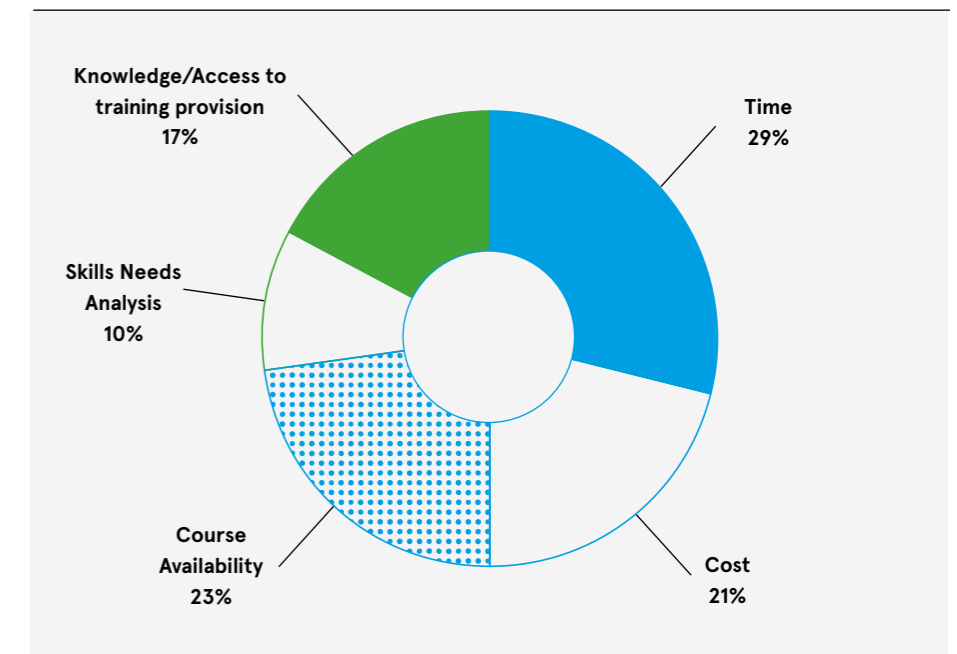
1. Employers see the potential for skilled general operatives to progress into higher skill roles, as competitive pressures drive employers to become leaders in advanced manufacturing practices. A training programme could be offered which delivers an introduction to 'Cross-Disciplinary Manufacturing Skills' covering the technical and transversal skills listed above. This could also be delivered to those outside the workforce (unemployed, women returners etc.) who have an aptitude for and are seeking employment in manufacturing technician roles.
2. An advanced version of this programme could be designed to meet the need for upskilling of existing manufacturing technician staff. Employers have cited the need for flexibility and increased ability to problem solve across a gamut of modern manufacturing technologies.

There is a lesser yet significant level of demand for Design, Robotics and Vacuum Systems skills which could be satisfied by providing courses in one or more of these areas subject to a minimum number of employers committing to taking up places.

### Consulting with Manufacturing Employers: Addressing Skill Needs

As part of the Audit's Methodology, respondents were asked about their strategies for addressing existing and emerging skills needs. Access to appropriate training was discussed along with barriers to sourcing the right talent in a rapidly evolving sector. Issues in Addressing Skills Needs are illustrated in Figure 7 for which an analysis follows.

Figure 7. Issues in Addressing Skills Needs



### Issues in Addressing Skills Needs: An Investigation

Barriers to developing skills within organisations included the need to train staff off-site on a regular basis. Although this is often the norm with regards to specialised training, finding the Time to do so was identified as the most significant barrier by **29%** of respondents<sup>15</sup>. A notable finding was the number of responses (**23%**) citing Course Availability as a barrier. This is directly correlated to the Knowledge of/ Access to Training Provision with **17%** of respondents highlighting the issue. Finally, analysing the skills needs of employees was identified by **10%** of respondents as a barrier in addressing skills shortages due to the resources required to carry out such analysis, especially for smaller enterprises. Concerns for the lack of locally-run courses were voiced as organisations opt to send staff to the UK for training. Cost (**21%**) was also flagged with the need to send staff elsewhere as a primary contributor. This further highlights a challenge in the provision of specialised knowledge resulting in the need for tailored in-house training from senior staff; training that may distract from the operational priorities of a company. It was also pointed out that if such courses were more readily available it would aid with the development and retention of local talent and support business development strategies.

<sup>15</sup>N= (58) Companies were given the option to select more than one barrier and therefore the figure for N is larger than the number of companies interviewed. All 26 companies identified at least one barrier.

### Operators: An Ongoing Demand

The demand for General Operative roles was indicated by a number of respondents as ongoing. Understanding the root of this demand is important for addressing skills needs as General Operative vacancies can often be the result of high turnover rates. However, in the case of the North West such demand is largely due to an increased in manufacturing activity in the region. There is an ongoing demand for both Computer Numerical Control (CNC) and production operatives, particular in the high-tech manufacturing/med-tech sector. While there are many job-seekers ready to take up these roles, they often lack the technical and digital competencies required for high technology automated manufacturing. Employers expressed that while it can be difficult to find people with this combination from day one, it is something that can be honed and developed through experience. To excel in this arena going forward, operators require technical know-how coupled with the right soft skills that foster professional development.

### Transversal Skills: The Importance of Human Capabilities

As technology infiltrates the modern manufacturing workplace, it is important to bear in mind the importance of human capabilities and the evolution of competencies in tandem with the adoption of emerging technologies and new manufacturing processes. This has been reinforced by the findings which indicate a need for strong transversal skills for optimal career progression. Further information gained through the interviews places problem solving and root cause analysis at the forefront in troubleshooting electrical and mechanical issues, a skill that is increasingly important in an era of digital transformation.

Findings also indicate difficulty in sourcing courses related to the following: vision systems; ultrasonic, advanced manufacturing technologies, and radio frequency welding as more activities become digitised. In the Action Plan for Jobs 2017, the Government outlined its intention to further develop cross border and international partnerships to support the development of emerging technologies. This initiative could be supported through existing training providers in the region, developing a continuum of manufacturing (Industry 4.0) training provision across further education and higher education. The presence of a strong consortium of manufacturing employers in the North West positions the region to develop a cohesive local strategy to further grow and up-scale industry with education and training provision at its core.

### Strong Industry Endorsement for Dual-Education Initiatives

For the purpose of this research, dual education initiatives refer to programmes of study designed and delivered by education and training providers in collaboration with industry. Companies were questioned on their receptiveness to dual-education initiatives for which 85% expressed support. The findings state that companies believe that apprenticeship/traineeship style programmes allow candidates to get involved in projects that better equip them for problem-solving in the future. Employers also spoke positively about work-based learning programmes designed for existing employees. Such work-based programmes need to be designed in conjunction with employers and delivered at a time, place and pace that suit the employer and employee. Learning in the workplace needs to be recognised and acknowledged and assessments should address opportunities or challenges facing the sector and employer organisation. As emerging technologies dramatically alter the skill sets that employers seek today, such dual-education initiatives are a good example as a way to deliver these skills for the sector combining learning and application.



## The Future of Work: Talent Retention in the North West

A standout finding was the growing need for the digitalisation of manufacturing processes in the region in which the real and virtual worlds converge through Industrial Internet of Things (IIoT), web 4.0 technologies, services and real-time management of data for the purpose of root cause analysis. The need for productivity tools/inventory management and logistics technologies were highlighted as escalating requirements to future-proof manufacturing sectors in the region with significant opportunities at both entry and competent level.

CNC Training and ISO Programming are also becoming increasingly attractive to companies seeking new hires but also desirable in the upskilling of existing staff. Overall, the need to advance skills and knowledge in the area of advanced manufacturing is fundamental to progress and to future-proof the manufacturing industry in Ireland (Ibec, 2018)<sup>14</sup>, for which technology is the catalyst for change. While concerns for the retention of talent was expressed by respondents, attracting talent back to the region may be an increasingly viable prospect.

The degree to which Dublin and other large cities are pressing against infrastructural constraints allows for the strengths of digitisation to dispel any concept of isolation with regards to those regions and towns beyond the existing urban conurbations and even small outflow by Dublin's standards can make a large impact on smaller regions<sup>15</sup>. As a result of the region's robust ICT presence, the North West is well-positioned for the 'future-proofing' of its traditional sectors offering optimal employment opportunities for the right talent. Investing in quality training is therefore pivotal in improving the performance of the regions existing industries and services for sustainable growth.

<sup>14</sup> Safeguarding Ireland's Manufacturing Future, Irish Medtech Association, Ibec 2018.

<sup>15</sup> FIT ICT Skills Audit 2018: Widening the ICT Talent Pipeline for Sustained and Inclusive Growth

## Specific Skills Required by Discipline

The survey responses were also analysed to determine the specific skills most in demand for each discipline. Details of the findings are presented in radar charts in Annex 1 providing the data in a form easy to assimilate and which gives readers an overview of the intensity of demand reported for each specific skill with a discipline. In each radar diagram:

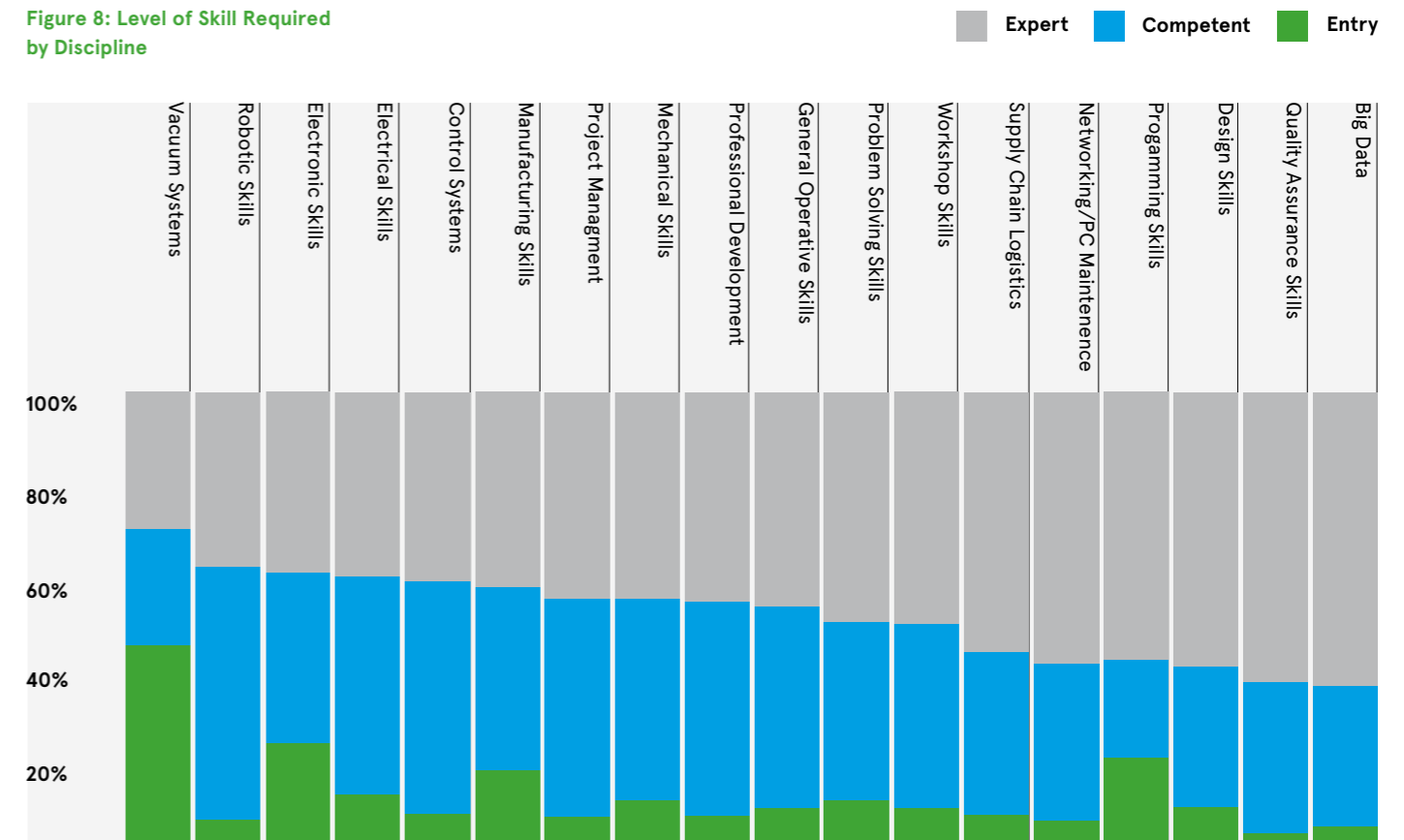
- The outermost ring represents the highest demand for a specific skill
- All rings represent significant demand, including the inner ones
- Different coloured symbols illustrate the demand for entry, competent and expert levels

— An accompanying table provides the same information in the form of a ranked list with the number one position occupied by the skill most in-demand.

Readers of this report are invited to explore the top-ranked skills/high demand roles as set out in the radar diagrams and accompanying tables in Annex 1. Each discipline has been presented separately to allow the reader to identify those which are of particular interest to them, or indeed all if a more comprehensive understanding is required.

For those who would prefer a summary overview of the skills needs in demand, the following General Findings should prove useful.

Figure 8: Level of Skill Required by Discipline



## General Trends in Relation to Manufacturing Skills Demand



**#1** In the **Electric Skills** Category Industrial Electrical Systems is the skill most in demand along with a requirement for 3 Phase systems and Electrical Test/Measurement capabilities.

**#2** Fundamental Electronic Knowledge is a standout requirement in the **Electronic Skills** discipline. Analog/Digital & Digital/Analog Conversion and AC Rectification follow closely, particularly at entry and competent level.

**#3 Mechanical Skills:** Hydraulics is top of the list at all three levels. Transversal skills such as Project Management and Professional Development are needed from entry level onward.

**#4** Strong demand for Welding skills in the **Workshop** discipline with Soldering and Machining (Drilling, Milling and Turning) required at entry and competent levels. Problem Solving required at all levels.

**#5** For those entering the **Design Skills** discipline 3D Printing, Solidworks and Programming/Development Support Skills top the list.

**#6** Inspecting Vacuum leaks was most sought after in the **Vacuum Systems** discipline. Following closely were skills in Vacuum Pumps and Problem Solving.

**#7** Demand for PLC's is evident at all levels in the **Control Systems** category with most demand at entry. Combined with Programming Skills would enhance an entry-level skillset.

**#8** In the discipline of **Networking/PC Maintenance** there was a clear top three across all levels; IP Networking; Wireless Networking and Network Security.

**#9** For **Supply Chain Logistics** requires skills in Inventory Planning and Inventory Management across all levels. Cost modelling is also a requirement.

**#10** Top **Manufacturing Skills** are Parts Inventory and Maintenance Planning closely followed by Predictive Maintenance Scheduling.

**#11** For the **Programming Skills** discipline C+ Programming, C++ & Delphi were highlighted as important across all levels. SQL Database and Java are also required.

**#12 Big Data** requires the same top three skills at all levels; SQL; My SQL and C++. Developing these skills is a good calling card for entering the sector.

**#13 Project Management** requires Experience in People Management at all levels. However, knowledge of PM tools such as Six Sigma/Lean and Agile/Scrum/Kanban would enhance entry roles.

**#14** Manual Handling is required at all stages of **General Operatives** with skills in Production Line Operation an added bonus at entry level.

**#15 Robotic Skills** require Robotic Programming Skills at all levels. An entry level skillset would benefit from knowledge of Robot Configurations. Demand for Robot teaching was strongest at competent level.

**#16** Knowledge of both National and International Quality Standards is key at all levels in the **Quality Assurance** category.

**#17** Good presentation and written communication skills are central to good **Professional Development** followed closely by Teamwork.

**#18 Problem Solving Skills.** Demand for critical thinking and analytical skills was evident at all levels. Technical Report writing was also required.

## Cross-Sectoral and Transversal Skills Required



To exploit the opportunities presented by emerging technologies, manufacturing organisations should invest significantly in upskilling their employees.

Education and Training providers must ensure that employers and employees have access to relevant and up-to-date programmes. The North West's ability to continually grow and attract investment will be dependent on readily available talent and highly skilled workers. The skills demanded by the sector are evolving with lower skilled positions at most risk from automation and growing demand for science, engineering and digital skills. Upskilling for the existing industrial workforce is vital to the long term sustainability and growth within the region's manufacturing sector and ultimately the regional economy.

The demand for skills in manufacturing covers a broad range of occupations and skill levels. While without a doubt technical abilities are a must, surprisingly many of the skills candidates are lacking are not technical but rather what can be described as the human skills (sometimes referred to as soft skills). These skills include communication, collaboration and creativity, as well as uniquely human traits like empathy, relationship-building, cognitive ability, curiosity and the desire to learn. Human strengths are skills that will augment technology and reduce the threat of replacement by automation. The respondents that contributed to this skills audit stressed the importance of recruiting employees who have the right mixture of soft and hard skills. **The ultimate blend is a combination of human skills + technical skills + digital skills.** Employers have called on local education and training providers to design programmes that address a combination of both the dedicated discipline learning outcomes but at the same time review broader transferable skills relevant to working in manufacturing and indeed other sectors. This requires programmes to be designed in a "T" shape where both broad transferable skills and discipline-specific skills are addressed. See Figure 9 right.

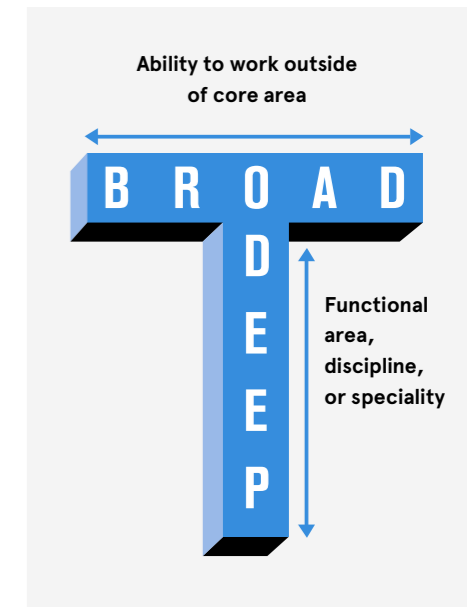


Figure 9: T Shaped Skills

When it comes to speed, efficiency and reliability, humans will struggle to compete with robots and other emerging technologies currently disrupting the manufacturing sector. However, we have to capitalise on our uniquely human traits such as empathy, collaboration, problem solving, relationship building and so on. Many of these skills are acquired outside the classroom and are best developed through work experience (e.g. part-time jobs), participating in team sports and involvement in community and charitable initiatives. Many respondents have suggested that the importance of developing human skills has been neglected in recent years. This message needs to be reinforced to students by parents, teachers, Guidance Counsellors and employers.

The following broad skills were identified by employers contributing to this study:

- **Communication skills:** Communications skills appear more important than ever. Digital and Tech skills have been emphasised throughout this report as being important but this should not be at the expense of communication skills. Much of the recent emphasis in education has been around STEM subjects (science, technology, engineering, and math) and proficiency in those areas is certainly important for today's students to understand the world around them. However, the ability to communicate ideas effectively is becoming a highly-prized skill.
- **Customer Experience:** Customers today expect the same service in their work life as they get in their personal life, which means 'business to business' organisations need to start behaving more like 'business to consumer' ones and treat the customer experience as sacred. Employees in all walks of life including manufacturing will now more than ever require skills in customer care/customer experience.

- **Problem Solving:** Problem-solving skills provide a good foundation for many of the roles emerging in the wider technology sectors and employers want to see this in new recruits. In manufacturing problem solving, a key method stands out: Lean. This problem solving method focuses in on eliminating waste and finding a solution as quickly and efficiently as possible. This is a leading method that manufacturing engineers use to solve problems throughout the production process.
- **Attitude:** Employers in this report and indeed other reports carried out by the Regional Skills Fora have highlighted the importance of recruiting new employees who have a "can-do" attitude. Employers are seeking employees who see things that need to be done themselves without having to be instructed.
- **Personality and Collaborating:** Employers are seeking employees who can fit into their organisational culture. There needs to be a match with the personality of the employee and culture of the organisation. Employers ask themselves "will this person fit into my team"? As mentioned above, experience in teamwork acquired either through work experience, sports or other collaborations can prove beneficial. The jobs of the future will not depend as much on knowing facts or crunching numbers as on humans collaborating with other humans to design work for machines. Collaboration will increasingly become a competitive advantage.
- **Project Management and Time Management:** An ability to work under pressure and meet deadlines has been identified by many employers as being a desirable trait amongst employees. Time management and scheduling skills are highly valued by employers across all sectors.

- **Ability to learn new skills quickly:** The manufacturing sector is moving at an incredibly fast pace where employees need an ability to pick up new skills quickly and therefore providers of education and training should incorporate modules or workshops that promote "learning to learn" new skills. Too much attention on specific skills is not recommended. Instead, the emphasis should be on learning students to learn themselves. The ability to gain new knowledge will be more valuable than the knowledge itself. The best way to prepare for the future is to develop the ability to learn and adapt.
- **Emotional Intelligence:** Those who can combine technological skills with emotional intelligence will be the most sought after in the coming years and decades. Empathy in particular was highlighted as a key trait highly valued by employers.
- **Design Skills:** That absence of empathy makes it hard for machines to design products and processes that will maximise enjoyment and utility for humans. So design skills are likely to be in high demand for decades to come as basic production and analytical processes are increasingly automated.

### Business Acumen Training

From completing this skills audit and from conducting follow up interviews with employers, it became apparent that a significant appetite exists amongst employers for business and management related upskilling. The following section provides an overview of some of the training areas recommended by employers.

1. **Team Lead/Supervision**  
Many of the employers that contributed to this report highlighted the need for supervision/team lead training for existing employees.

In many instances, team leads/supervisors were promoted as a result of their technical ability as opposed to their supervisory skills. Employers have suggested that short 4-10 day programmes covering the basics of supervision would be welcomed and well received by employers. These programmes would need to cover topics like recruitment, selection, induction, motivation, teamwork, performance management and managing conflict. The delivery should concentrate on the practical aspects of supervision.

2. **Sales and Digital Marketing**  
Employers that contributed to this audit highlighted sales and digital marketing as priority areas for training existing employees. Employers claimed that the vast majority of their employees come from a manufacturing/engineering background. In particular, the small and medium-sized organisations highlighted the importance of upskilling their staff in Sales and Digital Marketing. Many of these organisations are involved in marketing and selling products and therefore their staff need a certain level of business acumen. When probed about how this training could best be delivered, respondents suggested workshops delivered over 2-3 days by experienced sales/marketing professionals with B2B and B2C experience. In addition, a significant component of the training programme would need to focus on marketing and selling for the manufacturing sector. Some employers questioned why sales and marketing are not covered in all full-time degree programmes given their importance in today's business environment.

3. **Customer Experience**

While advances in technology have helped manufacturers create better products, buyers also have higher expectations than ever before. Many of the respondents that contributed to this study acknowledged that customer care/customer experience has become an increasingly important aspect of their business in recent years. Respondents suggested that customer experience is an area where they could make improvements and would need to invest in upskilling/consultancy in an effort to enhance their existing customer experience efforts.



1. **Portfolio of ‘Cross-Disciplinary’ Manufacturing Skills Courses**

The development of a portfolio of ‘Cross-Disciplinary Manufacturing Skills’ courses across the continuum of FE and HE provision (Level 5 to Level 9) in collaboration with the ETBs and HEIs would greatly enhance the growth prospects and employment opportunities within the manufacturing sector in the North West. Relevant pilot programmes could be designed in collaboration with local manufacturing employers to address critical requirements across all levels.

2. **Dual Education Initiatives**

To meet skill requirements, particularly at both entry and competent levels, apprenticeship/traineeship style programmes where structure and content are aligned with the skills needs of manufacturing sectors in the North West can be developed. One area highlighted in the report which may benefit from such an approach was Supply Chain Logistics. It is now increasingly acknowledged that dual-education approaches while addressing skills development optimise the work-readiness of participants and elevate transversal skills, enhancing career development and progression opportunities.

3. **Establishment of a Regional Manufacturing Forum**

Establish a regional Manufacturing Industry Forum to engage the cohort of manufacturing companies that expressed a willingness and desire to work with local education and training providers, to inform general programme development and to design and implement bespoke upskilling programmes.

Such an initiative would give greater visibility to the manufacturing sector within the region and thereby be an effective approach in both reaching and building the local workforce with a positive impact on the strength of the local economy. Following the publication of the ICT/FinTech Skills Report in 2018, cluster groups comprised of employers from the ICT/FinTech sectors along with local education and training provider representatives were formed by the RSF Manager in the North West. In addition to discussing the development of new programmes and editing of existing programmes, these clusters also promote working and studying in ICT/Fintech locally. The establishment of similar groups for the manufacturing sector in the North West would be highly beneficial.

4. **Bespoke Regional Manufacturing Programme**

There may be merit in developing a regional variant – bespoke to specialist requirements in the North West – similar to the Manufacturing Maintenance Technician Programme (NFQ Level 6) developed by FIT in collaboration with Intel, Kildare and Wicklow ETB and SOLAS for enterprises located in Leinster. With growing technological sophistication in manufacturing operations in the North West, there are increasing skill requirements for those who operate cutting-edge equipment across diverse plants in the region. Requirements highlighted during the audit includes competencies in engineering; electronic and mechanical processes; proficiency with control systems; CNC; quality assurance, problem solving and project management competencies.

5. **The Impact of Perception**

Perceptions of factory-type work as 'low-status' must be challenged, particularly where such routine work is viewed as foundational knowledge in companies whose employment practices and opportunities for progression and growth are structured and incremental. Manual work is not necessarily low-skilled. In many cases, it requires high levels of attention and an appreciation for quality assurance. Ireland has previously been recognised for its success in developing visible career paths in the manufacturing sector and it is a trait we must continue to demonstrate and strengthen. These careers paths tend to commence with a modest start, i.e. performing largely routine manual tasks, and progress to meet current and emerging needs of locally-based enterprise via continuous career mapping and skills development. As companies continue to embrace digitisation, employees who are equipped with both manual and digital skills are well-positioned to further the company's activities along with progressing their own career agendas.

6. **Technology and Manufacturing 4.0**

The North West should further leverage the region's robust ICT presence in future-proofing its manufacturing sector as well as other sectors. Investing in quality training is at the core of sustainable growth and should be supported in the creation of a continuum of advanced manufacturing/IIoT training provision across both FE and HE. With considerable demand at all levels being driven by the need for a range of technical competencies, ensuring that manufacturing 4.0 technologies (current and emerging) are encompassed into curricula in a timely manner better prepares manufacturing employees for the change in roles and the future of work.

Elevation of technological competencies across all level equips enterprises with the capacities to innovate, grow, boost productivity and fundamentally remain competitive.

7. **Continuous Professional Development**

Participation in training and development is key to addressing current and future skills gaps, as well as improving overall workforce performance. Accelerated reskilling programs with faster, shorter bursts of on-the-job, experiential training are required. With a growing demand for those at competent and expert level, it is necessary to promote workplace training provision to facilitate the upskilling of those employed in the North West's manufacturing sectors, particularly in SMEs. With the disruption of automation skewed towards routine jobs with low demand for transversal and social skills, there is a need for remedial training which highlights the importance of life-long learning. Understanding the training methods and requirements of existing companies in meeting their employee development needs requires further attention. A review of CPD methods and their relative cost-effectiveness would prove insightful, particularly for those with high staff retention rates.

8. **Educational Attainment and Employability**

St. Angela's College, IT Sligo and Letterkenny Institute of Technology are respected higher education institutions within the North West and are valued assets in each county's LECP and industry in the region. The two ETBs in the region (Donegal ETB and MSLETB) are both coordinating innovative employer initiatives with local industries and continue to enhance their offerings to those already in employment.

## "We need to train and educate 21st century students for 21st century jobs with 21st century methods"

Regional development strategies should reinforce the contribution of further education providers in developing skilled and talented individuals for entry into the workforce as well as preparing students to progress to higher education programmes. MSLETB and Donegal ETB need to be facilitated in furthering employer links that guide students directly into satisfying employment opportunities and in developing specialist modules or programmes that meet the skills needs of local enterprises and prepare people for quality employment locally. Not only does this benefit those in pursuit of a manufacturing career but also the education and training providers who witness, first-hand, the impact of such provision on the development and modernisation of the sector in the North West.

9. **Research Collaborations**

The North West is well served with three respected higher education institutes (HEIs). As manufacturing gets more advanced, the demand for employers to undertake in-depth scientific research will become increasingly important. This will provide an excellent opportunity for the HEIs in the region to expand their existing research offering into more applied areas concentrating on bespoke organisational or sector-wide issues affecting manufacturing. This research will be significantly different from the traditional research undertaken by full-time students as the contribution to practice will prioritise over the contribution to theory. The research requirements from an employer's perspective may be more aligned to a Doctor of Business Administration (DBA) than the traditional PhD. Like the PhD, a DBA is a doctoral qualification, however it is directly linked to the world of work – making a practical solution to a business problem.

The PhD on the other hand offers the opportunity to undertake in-depth research to contribute to the advancement of knowledge. The HEIs in the region are already well equipped to address this with their incubation centres facilitating industry-education collaborations in a wide range of areas including research.

In addition, providing full-time students with opportunities to engage in real life research studies (as opposed to completing fictitious case studies) coordinated by local employers is an idea that should be explored by HEIs. It is already happening on a small scale but its full potential is not being realised. This would be especially relevant to Level 8 and Level 9 learners. For this to happen, the HEI and interested employer should carefully identify and approve research topics that address both the academic and industry requirements.

## The Education and Training Providers in the Region



The education and training providers in the North West (MSLETB, Donegal ETB, St. Angela's College, IT Sligo and Letterkenny IT) have excellent track records in responding to the needs of industry. All of these providers are engaging members of the North West Regional Skills Forum and have in recent years implemented a number of initiatives to address industry requirements in relation to education, training, research and recruitment.

This section provides a brief update from each of the providers in relation to some of the initiatives relevant to the Manufacturing sector.

### MSLETB

Education and Training Boards (ETBs) are established under and are governed according to the Education and Training Boards Act 2013. Each ETB is a statutory body with its own corporate status. Mayo Sligo and Leitrim Education and Training Board (MSLETB), the leading provider of further education and training in Mayo, Sligo and Leitrim, is one such ETB which combined the services delivered through the former County Vocational Education Committees and the training services previously delivered by FÁS/SOLAS in those three counties.

MSLETB offers a diverse range of manufacturing focused and related programmes through our network of Training Centres and Colleges of Further Education and Training. Courses are delivered all year round and lead to accreditation at levels 4–6 on the National Framework of Qualifications and/or certification from a recognised industry accredited body. Courses such as Welding & Fabrication, Cleanroom and Packaging Operations and Machine Tool Operations (Milling & Turning) for example are available on a full time or part time basis.

Through the new "Skills to Advance" is an initiative through which MSLETB supports employers and enterprise through the development of people who are already in employment by providing new and/or specific training interventions. Employees can access our Further Education and Training (FET) Programmes via their employers or they can directly engage with MSLETB by enrolling in one of our FET programmes/Workforce development options. Workforce development training is provided at mutually agreed times. It can be modular, flexible, on a part-time basis during the day or in the evenings or online.

The majority of our training, up to levels 5 & 6 on the National Framework Qualifications, are provided free of charge under the "Skills to Advance Initiative" (Subject to qualifying criteria: for more info email [skillstoadvance@msletb.ie](mailto:skillstoadvance@msletb.ie)) Where charges apply for specific interventions fees are decided on a case by case basis and are determined by the economic cost to deliver the training, the ability of the employer/employee to pay the fees and the benefits of developing skills for the economy

#### Summary of our Services

##### "Skills to Advance"

For Employers and Enterprise: Skills to Advance can support small and medium-sized enterprises (SMEs) who need some assistance with developing and upskilling their existing workforce to improve retention and become a more resilient organisation. For Employees: this is a new initiative to provide free training for employees in vulnerable groups and sectors in the Irish workforce. The focus is on people who need more opportunities to advance in their working lives and careers in order to help them stay in their existing employment and/or to access emerging job opportunities.

**Specific Skills Training (SST)** courses are typically around 6 months to complete and are designed to meet the needs of industry across a range of sectors. QQI accreditation is at levels 4–6 on the National Framework of Qualifications (NFQ) and/or industry specific qualifications. Examples of SST courses include, Welding and Fabrication, Computer Applications and Office Skills, eBusiness, MySQL, Precision Engineering, Software Development. These programmes typically include work experience/practice modules with paid placements of 3–6 weeks.

**Post Leaving Certificate (PLC)** provides courses in a combination of general studies, vocational skills and opportunities for work experience so students can enter or re-enter skilled employment in the labour market. Courses generally lead to major awards at NFQ Levels 5 and 6. Typically, courses are one academic year on a full time basis.

**Traineeships** provide job-specific training which combines direct training and a significant workplace training element (Work Based Learning, WBL element) with an employer. Trainees in receipt of a training allowance will continue to receive their allowances from MSLETB for the duration of their work experience. All programmes lead to QQI Major Awards at levels 4 to 6 on the NFQ. Traineeships take six - eighteen months to complete (up to 50% of which could be in the work place).

**Apprenticeships:** To undergo an Apprenticeship programme individuals must first be registered by an approved employer. If you are an employer and want to register an apprentice but are not yet approved, please contact [apprenticeship@msletb.ie](mailto:apprenticeship@msletb.ie) for more information. All Apprentice registrations for approved employers based in Counties Mayo, Sligo & Leitrim are processed through MSLETB.

Apprenticeships now included all of the traditional craft apprenticeships such as Electrical, Tool Making, Machine Automation & Maintenance Fitting, Vehicle Body Repair and Electrical Instrumentation all of which are delivered in our Centres in Sligo & Ballina and the new generation apprenticeships such as Original Equipment Manufacturing (OEM), Industrial Electrical Engineering, Polymer Processing Technology, Manufacturing Engineering and Manufacturing Technology. For more information on any apprenticeship [email us at apprenticeship@msletb.ie](mailto:apprenticeship@msletb.ie)

## The Education and Training Providers in the Region

**Vocational Training Opportunities Scheme (VTOS)** provides a range of courses to meet the education and training needs of people who are unemployed. It gives participants opportunities to improve their general level of education, get a certificate, develop their skills and prepare for employment, self-employment and further education and training. Some examples include ICT, Art and Design, Business Administration, Childcare, Digital Media, Sound Production, Institute of Accounting Technicians and Leaving Certificate.

“**Skills for Work**” is a programme aimed at providing opportunities to help employees upskill to meet demands of the workplace. Programmes are 35 hours duration and designed in a flexible way to meet the needs of employer and employee. Most programmes are accredited.

**Part-time Evening courses** of typically 30 hours duration over 10 weeks provide short up-skilling modules for both unemployed and employed persons. Examples of courses include Welding (TIG & MIG), Interior Design, ECDL, CAD, Door Security, Supervisory Management, and Start Your Own Business. Courses generally lead to accreditation at levels 4-6 on the NFQ or certification from an Industry accrediting body.

**eCollege:** Delivers courses in business, project management, SQL, Cisco, graphic design, web design, digital marketing, software development and basic computer literacy, online and through distance training courses are also available for people in employment who wish to update their skills. There is a fee for people in employment but subsidised rates are available for employers who wish to enhance the skills of their employees.

**For a full “Directory of our Services” and Employer Services see: - [msletb.ie](http://msletb.ie)**



## Donegal Education & Training Board (ETB)

**Donegal ETB is the largest education and training organisation in the county. It manages 15 out of the 27 post-primary schools in Co Donegal, Gartan Outdoor Education and Training Centre, Donegal Music Education Partnership and has legal responsibilities for youth work. It is also the largest Further Education and Training (FET) provider in the county with almost 12,000 learners completing courses through its service in 2017.**

### Approach to working with Industry

Donegal ETB’s FET Service works closely with local industry (from small and medium enterprises to multinational organisations) to ensure the delivery of high-quality FET programmes which are responsive to the changing needs of the economy. In addition to our industry focus, Donegal ETB also prides itself on its ability to engage with learners on the ground to meet their learning requirements by offering an extensive array of programmes from QQI Levels 1 to 6 on the National Framework of Qualifications, as well as courses with specific industry-recognised certification. This ensures that learners with Donegal ETB are best placed to enter the labour market, upskill or change career direction where sustainable employment opportunities are in existence and continue to grow.

A recent key initiative in engaging with industry is the development of new Career Traineeships. (Industry focused training programmes with significant work placement elements)

Donegal ETB has an established Enterprise Engagement Group along with dedicated Liaison Officers who engage with employers at the outset and undertake extensive sector specific skills profiling of industries to establish where the gaps are in terms of skills and qualifications; course content is then developed and agreed by the relevant industry in conjunction with the ETB thus ensuring the programme is fit-for-purpose and up-to-date. Tutors, who are responsible for the delivery of the day-to-day learning and training, also have the opportunity to engage with industry, thus strengthening relationships and facilitating the further development and adaptation of the programmes following the pilot phase. The importance of “on- the-job training” and longer work placements have long been identified by employers as a key priority and consequently, Donegal ETB Career Traineeships in-company placements now account for a minimum of 30% of the course duration. Work placements for specific skills training courses have also been extended, resulting in an excellent level of in-company placements and an anticipated increase in employment outcomes.

### Donegal ETB and the Engineering sector

Donegal ETB’s on-going engagement with the Engineering sector has resulted in positive relationships with globally recognised companies such as Inishowen Engineering, E&I Engineering, Sea Quest, Mooney Boats, Irish Pressings and many others.

Fruitful relationships have also been established with a wide variety of other business sectors in the county, including hospitality, ICT, retail, financial services and healthcare. All of these sectors and businesses are working collaboratively with Donegal ETB to provide essential in-company work placements and employment opportunities to Donegal ETB learners.

Industry engagement and feedback has also highlighted the need to continuously change the course content of our existing courses. Staff recently developed a new Traineeship in Engineering Operations having worked closely with the relevant companies in Donegal. Other Engineering sector offerings currently include Basic Welding, Intermediate Welding, Coded Pipe Welding and numerous Welding Night Classes focused on upskilling those employed in the sector.

### Relationships with Employers

Working in collaboration with the NW Regional Skills Forum, Donegal ETB was the first ETB in the country to develop an Employer Portal to provide industry with up to date information about the availability of courses and the many different ways in which these courses can be delivered. While many of the programmes are specifically designed to target people who are seeking employment, bespoke training can also be provided for those who are currently in employment. The Employer Portal is user friendly in its design and allows prospective employers to register their interest in offering In-Company placement or guest presentations to learner groups. The Portal also signposts employers to relevant contacts and services within the ETB. In the future Donegal ETB plans to extend this Portal to allow employers to upload job vacancies so that the gap from training and development into employment can be bridged more effectively.

**For a full “Directory of our Services” and Employer Services see: [www.donegaletb.ie](http://www.donegaletb.ie)**



## The Education and Training Providers in the Region

### IT Sligo

IT Sligo works closely with industry to determine the current and future needs of employers in relation to education and skills. These collaborations aid in the design of new programmes, and assist in the review of existing programmes to ensure that they continue to meet industry needs. Programmes in the Faculty of Engineering & Design from level 6 to level 9 such as Mechanical, Precision, Mechatronics and the Quality suite of programmes are in high demand. IT Sligo established online learning in 2002, and we have since become the leader in Ireland in the use of technology in the delivery of distance education with over 3,000 students currently studying online. Our suite of over 110 online programmes are designed and delivered for students who want to study part-time, at a pace that facilitates their work life balance. IT Sligo delivers online programmes in the Faculties of Engineering & Design, Faculty of Science and Faculty of Business & Social Sciences. Student numbers have grown from 5 students studying online in 2002 to over 3,000 in 2019. As part of the strategic plan for IT Sligo, a target of 6,600 students has been set for 2022. This target will be met by the implementation of new programmes in association with industry needs and by further increasing class sizes.

Recent EFGSN reports have identified that Biopharmaceutical Science is an area of future skills growth, and IT Sligo delivers programmes in collaboration with NIBRT in the Biopharma area. These programmes assist in up-skilling participants to meet the needs of some of the world's largest multinational MedTech companies, which have facilities in the North West.

IT Sligo has also received funding for Springboard programmes, since the initiative's development by the HEA in 2011. Springboard programmes are designed to meet current skills shortages in industry, and to provide participants with the in-demand skills identified by the Expert Future Skills Report. The Institute is well placed to educate our future engineers and leaders, who will work in increasingly multi-disciplinary and technologically challenging environments. For this the Faculty of Engineering & Design will be launching a set of level 8 and 9 programmes in Industry 4.0. The aim is to develop and strengthen regional knowledge and expertise in the new models of manufacturing for smart, virtual and digital factories.

Faculty	Programme Disciplines (2018/19)	Fulltime	Online/ Part-time	Apprenticeship
Engineering & Design	Mechanical/Precision Engineering	X	X	
	Toolmaking			X
	Mechatronics/Automation	X	X	
	Polymer Processing		X	X
	Electrical			X
	Electronic Engineering	X	X	
	Connected Autonomous Vehicles		X	
	Computing	X	X	
	Project Management		X	
	Manufacturing			X
Science	Quality/Lean		X	
	Good Manufacturing Practice		X	
	Occupational Safety & Health	X	X	
	Pharmaceutical/Biopharmaceutical Science	X	X	
	Bioprocessing Technologies		X	
	Medical Biotechnology	X	X	
	Medical Technology Regulatory Affairs		X	
	Food Regulatory Affairs		X	
	Cleanroom Manufacturing		X	
	Agri-food Science	X		
Business & Social Science	Environmental Science/Protection	X	X	
	Marketing	X	X	
	Accounting	X	X	
	Business/Business Administration	X	X	
	Human Resource Management	X	X	



## The Education and Training Providers in the Region

In addition to delivery of programmes to help develop the sector's workforce, the Institute also provides direct support to companies in the sector. Through the Precision Engineering & Manufacturing (PEM) Strategic Research Centre, the PEM Technology Gateway and the Contract Research Unit, the Institute carries out work every year with dozens of manufacturing companies to provide support with product or process innovation or commercial development such as addressing new markets.

The Institute has also supported new start-up companies in the sector, both through providing space and support facilities in its Innovation Centre, and through the New Frontiers programme which provides training and mentoring for new start-ups.

**Each year nearly 1,200 STEM students graduate from IT Sligo. Many of these are available to work in the Manufacturing Sector in the North West region. IT Sligo run a number of annual events to promote skills and programmes that are key to the Manufacturing Sector in the North West including:**

### IT Sligo's annual skills promotion events that are key to the Manufacturing Sector

Month	Activity	More information
January	IT Sligo Open Evening	<a href="http://www.itsligo.ie/marketing-communications">www.itsligo.ie/marketing-communications</a>
February	Sligo Engineering Fair	<a href="http://www.itsligo.ie/engineeringfair">www.itsligo.ie/engineeringfair</a>
February/March	Engineers Week	<a href="http://www.engineersweek.ie/">www.engineersweek.ie/</a>
March-April	Transition Year Tasters on campus	<a href="http://www.itsligo.ie/marketing-communications">www.itsligo.ie/marketing-communications</a>
April	IT Sligo Open Day	<a href="http://www.itsligo.ie/marketing-communications">www.itsligo.ie/marketing-communications</a>
May	Sligo Engineering & Technology Expo	<a href="http://www.itsligo.ie/engineeringexpo">www.itsligo.ie/engineeringexpo</a>
May	Engineering Your Future – Transition Year Programme	<a href="http://www.steps.ie/eyf">www.steps.ie/eyf</a>
June-July	ICT Sumer Camps	<a href="http://www.itsligo.ie/marketing-communications">www.itsligo.ie/marketing-communications</a>
October	IT Sligo Open Day	<a href="http://www.itsligo.ie/marketing-communications">www.itsligo.ie/marketing-communications</a>
October	Maths Week	<a href="http://www.mathsweek.ie">www.mathsweek.ie</a>
November	Sligo Science Fair	<a href="http://www.itsligo.ie/scienceweek">www.itsligo.ie/scienceweek</a>
November	Sligo Science Festival	<a href="http://www.itsligo.ie/scienceweek">www.itsligo.ie/scienceweek</a>
November	ICT Information evening for Parents, Guidance Counsellors and Post Primary Principals and Teachers	<a href="http://www.itsligo.ie/marketing-communications">www.itsligo.ie/marketing-communications</a>
November – April	CanSat	<a href="https://esero.ie/cansat/">https://esero.ie/cansat/</a>
School term time	STEM specific age-appropriate workshops in local schools	<a href="http://www.itsligo.ie/marketing-communications">www.itsligo.ie/marketing-communications</a>
School term time	Schools liaison team visit	<a href="http://www.itsligo.ie/marketing-communications">www.itsligo.ie/marketing-communications</a>
Saturdays during School term time	CoderDojo	<a href="https://coderdojo.com">https://coderdojo.com</a>

### Centre for Precision Engineering Materials & Manufacturing Research (PEM Research Centre)

The PEM Research Centre was established in IT Sligo in 2013 and comprises of a number of Principal Investigators, who have all individually demonstrated notable research achievements through engagement with industry. The PEM Research Development and Innovation (RDI) themes are complementary and provide opportunities for convergence towards a unique single industry R&D support offering in precision engineering, manufacturing and materials. The PEM Research Centre is a founding partner in the I-Form Advanced Manufacturing Research Centre funded (€18m) by SFI and the Northwest Centre for Advanced Manufacturing funded (€8.7m) by Interreg VA. The PEM Research Centre is currently engaged with collaborative applied research projects with a number of large manufacturing companies in the Northwest including, Abbott, GSK and Abbvie. The Centre is also designated by Enterprise Ireland as the national Technology Gateway to support the RDI needs of the manufacturing sector through the PEM Technology Gateway that was established in 2016.

### PEM Technology Gateway

Building on the Institute's research strengths in engineering, material science, laser processing, micro-machining, polymer processing, rapid prototyping, general manufacturing process control and statistical process analysis, the PEM Technology Gateway provides engineering/technical solutions and process improvements across the full product lifecycle, with particular specialisation in Product design & development, Manufacturing and Materials.



## The Education and Training Providers in the Region

### Letterkenny Institute of Technology (LYIT)

#### LYIT Support to Manufacturing Industry

##### Degree Programmes

LYIT offers a range of programmes that are attuned to the needs of the manufacturing sector in the region. Degree programmes in mechanical engineering, computer engineering, electronic engineering and embedded system design produce graduates that are sought after by employers in areas such as mechanical design and production, medical equipment and electrical control systems. These graduates are knowledgeable in traditional and modern manufacturing systems, are familiar with the latest management tools and techniques and use industry standard software in the course of their studies. LYIT engineering degrees build on the underpinning theory in fundamental areas of maths and science with an emphasis on practical project work that increases in complexity as students progress through their programmes. This project work engenders the creativity and structured approach required to solve real world engineering problems, promotes the use of project management and control systems, and encourages important personal attributes such as presentation skills and team working.

In addition to the provision of educational programmes, LYIT collaborates with a range of industry and academic partners in the delivery of technology transfer and development projects across a range of topics including renewable energy, marine, wireless sensor and embedded systems, and advanced manufacturing.

These projects are supported from a diverse range of national and European funding programmes including Interreg, Horizon 2020, Erasmus+, InterTradelreland Fusion and Enterprise Ireland Technology Gateways. Three funded projects are of particular significance to manufacturing industry in the region: WISAR, NWCAM and InterTradelreland Fusion.

##### InterTradelreland Fusion Projects

Fusion is an InterTradelreland initiative based around an all-island network of industry and academia. The School of Engineering has been successful in obtaining funding for numerous Fusion projects going back over 10 years. Product development and innovation is at the heart of growth but often needs time, money and the right expertise. The Fusion programme provides that support for companies by helping them fund a high calibre science, engineering or technology graduate and partnering them with a third level institution with specific expertise. The graduate is employed by the company and is based in the company with mentoring from the academic partner. Fusion is an all-island programme so the third-level institution and the company which are partnered must be based in the different jurisdiction. This means that LYIT projects are with companies in Northern Ireland and this has proved very useful in networking with the various mechanical design and equipment manufacturing companies which are relatively close to the border. Typical recent projects have included the application of CAD/CAM techniques in the design and manufacture of new product lines with testing and simulation using finite element analysis.

##### WISAR Lab

The WISAR Lab research centre at LYIT works with companies locally and nationally in building an advanced capability embedded systems for industrial control with experience helping manufacturing companies address Industry 4.0 and specific market challenges. The lab also provides experience in wireless sensor and network applications and has worked with over 100 companies to date.

The WISAR lab provides innovative Internet of Things solutions to a wide range of industries and has worked with over 55 companies specifically in IoT. The Internet of Things is primarily focused on interconnecting any set of entities that require an embedded system for the purpose of enhancing, monitoring and controlling the entities or the service they provide. The lab provides expertise in embedded systems development (including sensors and actuators), wireless communications (including wireless protocols and antenna design), data aggregation, analysis, transmission and storage (from SD cards to Cloud storage) for manufacturing industry clients. The lab also incorporates the Enterprise Ireland funded WISAR Technology Gateway. To date the lab has received funding in excess of €10 million from public, industry and EU sources.

The research work of the WISAR Lab focuses on Body Area Networks (BAN) and the application of wireless sensor networks in buildings, and with industry processes, with an emphasis on evaluating and minimising the power consumption of the devices used. In particular, WISAR's research work concentrates on:

- the design and analysis of the MAC and Routing Protocols to be used in a BAN and evaluating the protocols' performance in real BAN testbeds and simulated environments
- the design of wireless sensor technology for networks for environmental monitoring and control, with a deployed office testbed, using off the shelf 802.15.4 technology and our own hardware and software platforms.

##### NWCAM

The North West Centre for Advanced Manufacturing is a €9.1m Interreg VA funded project. Partners include Catalyst Inc. (as lead partner) and: Ulster University, University of Glasgow, Letterkenny Institute of Technology, Institute of Technology Sligo, Derry City & Strabane District Council; as well as manufacturing companies specifically within the healthcare sector. LYIT was awarded €570K and the work proposed is complementary to that already undertaken through the WISAR Lab.

The project involves the creation of an Advanced Manufacturing super cluster combining the collective and complementary strengths of the partner institutions. Four thematic research areas are proposed; Sustainable Manufacturing, Advanced Polymer Products, Additive Manufacturing, Nano Manufacturing. The project proposal links LYIT and University of Ulster as cross border research partners for the additive manufacturing theme with a target of three peer reviewed journal and conference papers with cross-border authorship. LYIT's contribution is to develop new sensor and

control systems for innovative additive manufacturing processes for the project's industry partners. A major output of the project is that the skills and expertise developed within NWCAM are available to all manufacturing companies in the NW.



lyit

Institiúid Teicneolaíochta  
Leitir Ceanaínn  
Letterkenny Institute  
of Technology

## The Education and Training Providers in the Region

### Food Technology Centre – St. Angela's College, Sligo

The Food Technology Centre was founded and set up by St. Angela's College (SAC) Home Economics department initially in 1997. The Food Technology Centre team work in close co-operation with the Home Economics Department of St. Angela's College in food product development, research and education. In terms of resources the Food Technology Centre has access to all of the specialist facilities of the Home Economics Department including food practical laboratories, new product development kitchen, sensory suite, lecture rooms, library facilities, etc. The Food Technology Centre staff can draw upon the relevant specialist expertise in food science, technology, microbiology, nutrition, production, food safety, food policy, food business, etc. from the relevant academics within the Home Economics Department. The academics of relevance are involved in various research projects funded for example by Science Foundation Ireland, Safefood, Department of Agriculture, Food and Marine (FIRM), etc.

The focus of St. Angela's Food Technology Centre (SAFTC) is to explore opportunities for food research, knowledge transfer, education/training and commercialisation activities targeted at start-up, micro, small and medium sized food enterprises. SAFTC is the only such centre based in the BMW region supporting innovative food product development and commercialisation.

#### Current activities and programmes

SAFTC provides customised food technology solutions from concept development to commercialisation for innovative food companies. The Centre has a track record of working with food companies spanning all food sub-sectors including meat, dairy, bakery, beverages, fish, jams, preserves, chutneys, ethnic foods, free from foods, functional foods, pet food, etc. SAFTC provides assistance with recipe development, nutritional analysis, labelling legislation, shelf life verification, sensory analysis, food safety management systems, food auditing, combined with mentoring and knowledge transfer services where appropriate. In terms of the geographic spread the Centre can boast working with at least one food company from every county on the island of Ireland with a high percentage in the western region. Most of our clients are either start-up or micro sized ( $\leq 10$  employees) enterprises. SAFTC is primarily focussed on the application of applied science to the food sector through food product development and commercialisation.

Since 1997 SAFTC has delivered hundreds of projects for local and national food & drink companies with the work of SAFTC been associated with many award winning products and projects across the country.

#### NUI Galway Plant and Agricultural Bioscience Centre

In 2016 St. Angela's Food Technology Centre (SAFTC) joined the NUI Galway Plant and Agricultural Biosciences Research Centre (PABC). The PABC is an interdisciplinary Research Centre comprising researchers, research groups, companies and institutions sharing a common interest in fostering and promoting plant and agricultural biosciences innovation, ([www.plantagbiosciences.org](http://www.plantagbiosciences.org)).

The PABC comprises over 30 research groups across NUI Galway working on agri- or agri-food related topics, leveraging circa €8 million per annum in research funding, with approx 40 PhD students and 20 postdoctoral researchers, generating over 100 peer-reviewed research publications each year on agri and agrifood related research. Key themes of relevance for SAFTC within the PABC include sustainability, food, feed and nutrition.

SAFTC currently leads one of the research themes of the PABC on the topic of Food Science & Technology. i.e. "Food Science & Technology: Food science and technology harnesses a range of disciplines such as biology, chemical engineering, and biochemistry to better understand food processes and ultimately improve food products for consumers. Food scientists study the physical, microbiological, and chemical makeup of foods, and apply their research to develop the safe, nutritious and sustainable foods for consumers. The St Angela's Food Technology Centre within the PABC is committed to the development of the very highest standards in all areas of food production and supply, catering to the needs of the food industry including food production and processing, hotels, restaurants, catering and retailers. The SAFTC Team have expertise in New Product Development, Sensory Analysis, Nutritional Analysis, Labelling, Food Industry Training and in Food Safety Management." **See: [www.plantagbiosciences.org/research-themes](http://www.plantagbiosciences.org/research-themes)**

SAFTC works with economic development organisations in the public and private sector, with state agencies, local communities and the wider society. This approach benefits research, educational achievements and ultimately contributes to economic and social development.



St. Angela's College, Sligo  
Coláiste San Aingeal, Sligeach  
A College of NUI Galway

# 12

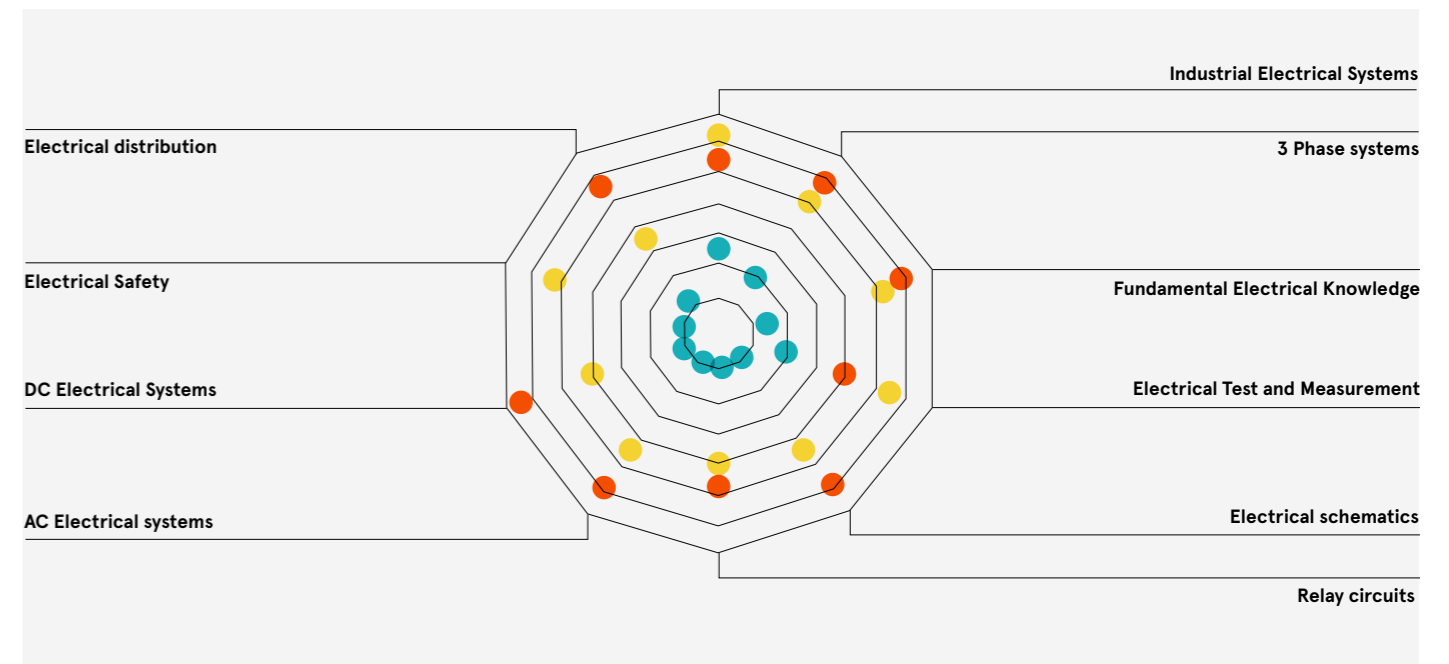
# Annex 1: Disciplines

## Discipline 1: Electrical Skills

In the Electrical Skills Category, Industrial Electrical Systems is the skill set most in demand. Demand for 3 Phase Systems is evident at all levels. These skills combined with Fundamental Electrical Knowledge and Electrical Schematics would be a strong profile for those at entry and competent level.

Electrical Skills

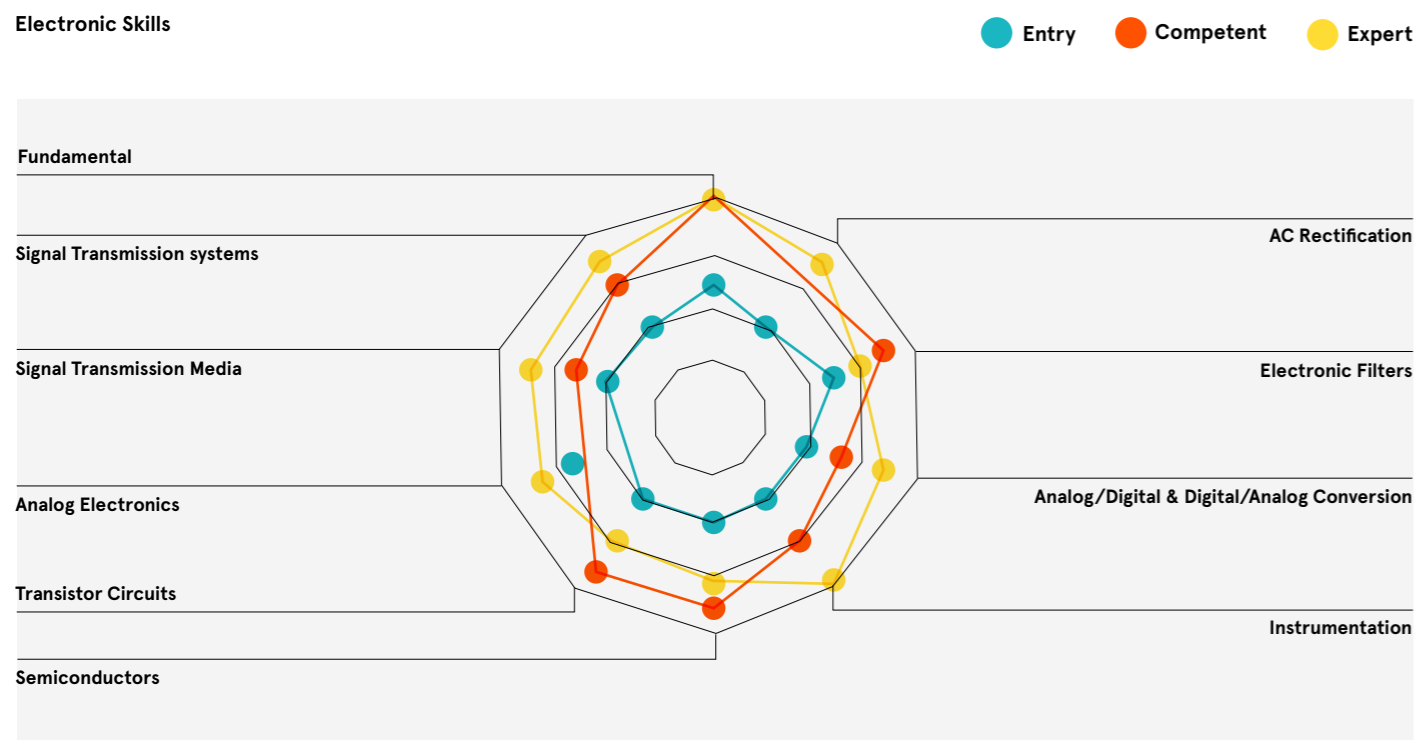
● Entry ● Competent ● Expert



Rank	Entry Level	Competent Level	Expert Level
1	Industrial Electrical Systems	DC Electrical Systems	Industrial Electrical Systems
2	3 Phase systems	Electrical schematics	Electrical Test and Measurement
3	Electrical Test and Measurement	AC Electrical systems	3 Phase systems
4	Fundamental Electrical Knowledge	Industrial Electrical Systems	Fundamental Electrical Knowledge
5	Problem Solving	3 Phase systems	Relay circuits
6	Professional Development (Soft Skills)	Fundamental Electrical Knowledge	Electrical Safety
7	Electrical schematics	Relay circuits	Electrical schematics
8	Relay circuits	Electrical distribution	AC Electrical systems

## Discipline 2: Electronic Skills

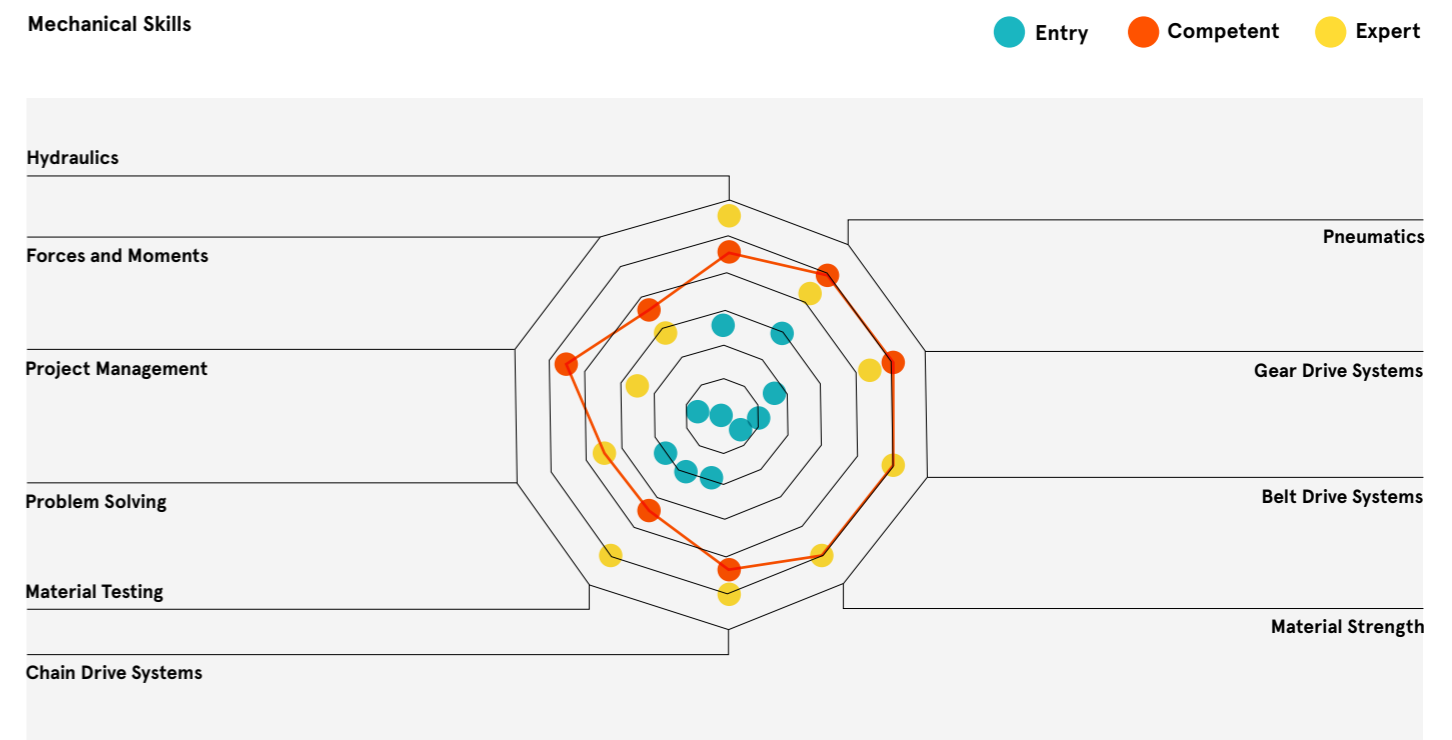
In the Electronic Skills discipline, Fundamental Electronic Knowledge is a standout requirement across all levels. AC Rectification, Electronic Filters and Analog/Digital & Digital/Analog Conversion follow closely, particularly at entry and competent levels.



Rank	Entry Level	Competent Level	Expert Level
1	Fundamental Electronic Knowledge	Fundamental Electronic Knowledge	Fundamental Electronic Knowledge
2	Electronic Filters	AC Rectification	Instrumentation
3	Analog/Digital & Digital/Analog Conversion	Electronic Filters	AC Rectification
4	Analog Electronics	Semiconductors	Analog/Digital & Digital/Analog Conversion
5	AC Rectification	Transistor Circuits	Signal Transmission systems
6	Instrumentation	Analog/Digital & Digital/Analog Conversion	Signal Transmission Media
7	Semiconductors	Instrumentation	Electronic Filters
8	Transistor Circuits	Analog Electronics	Semiconductors

## Discipline 3: Mechanical Skills

Hydraulics is the most sought after skill in the Mechanical Skills discipline followed by Pneumatics and Gear Drive Systems. Knowledge of Belt Drive Systems, Gear Drive Systems and Material Testing would be a good calling card across all levels. Transversal Skills such as Project Management and Professional Development are notable in demand at entry level.

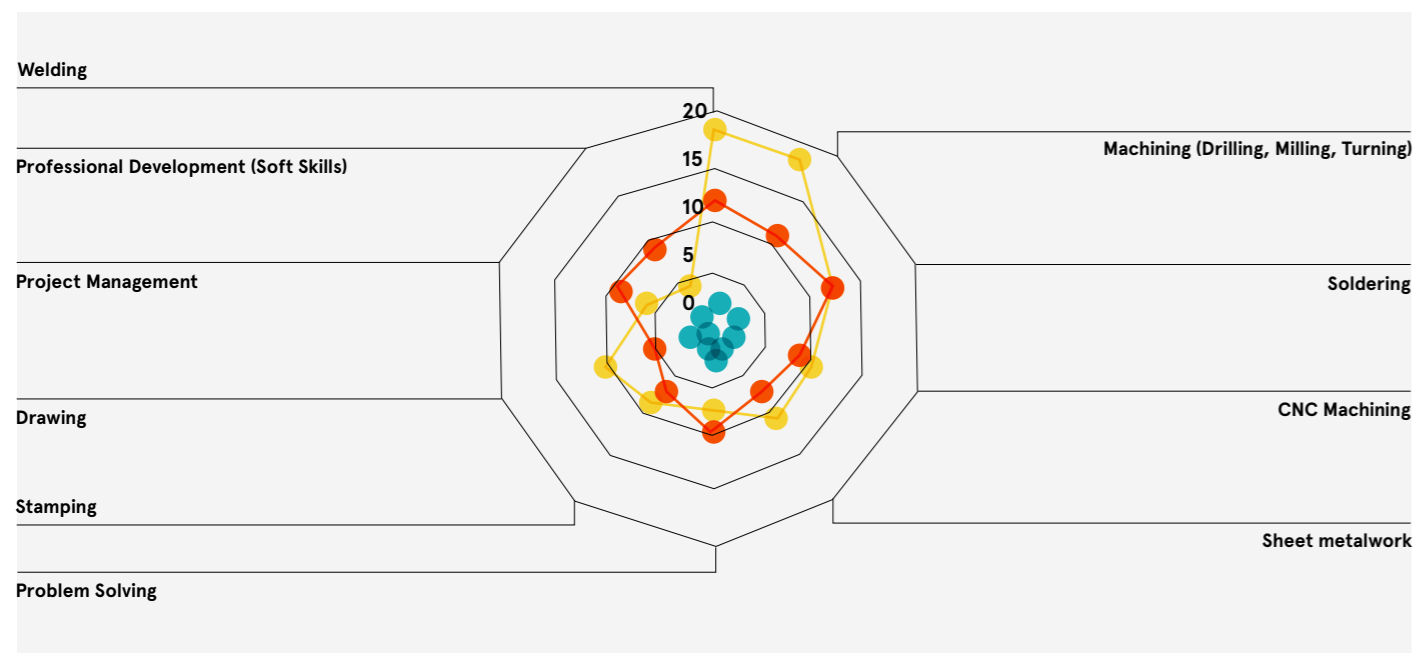


Rank	Entry Level	Competent Level	Expert Level
1	Hydraulics	Hydraulics	Hydraulics
2	Pneumatics	Pneumatics	Belt Drive Systems
3	Gear Drive Systems	Gear Drive Systems	Material Strength
4	Belt Drive Systems	Belt Drive Systems	Chain Drive Systems
5	Chain Drive Systems	Material Strength	Material Testing
6	Material Testing	Chain Drive Systems	Pneumatics
7	Problem Solving	Project Management	Gear Drive Systems
8	Professional Development (Soft Skills)	Material Testing	Problem Solving

## Discipline 4: Workshop Skills

In the Workshop discipline, the specific skill most sought after is Welding, with Soldering and Machining (Drilling, Milling, and Turning) also in strong demand at entry and competent level. Demand for Problem Solving Skills is evident at all levels.

Workshop Skills ● Entry ● Competent ● Expert

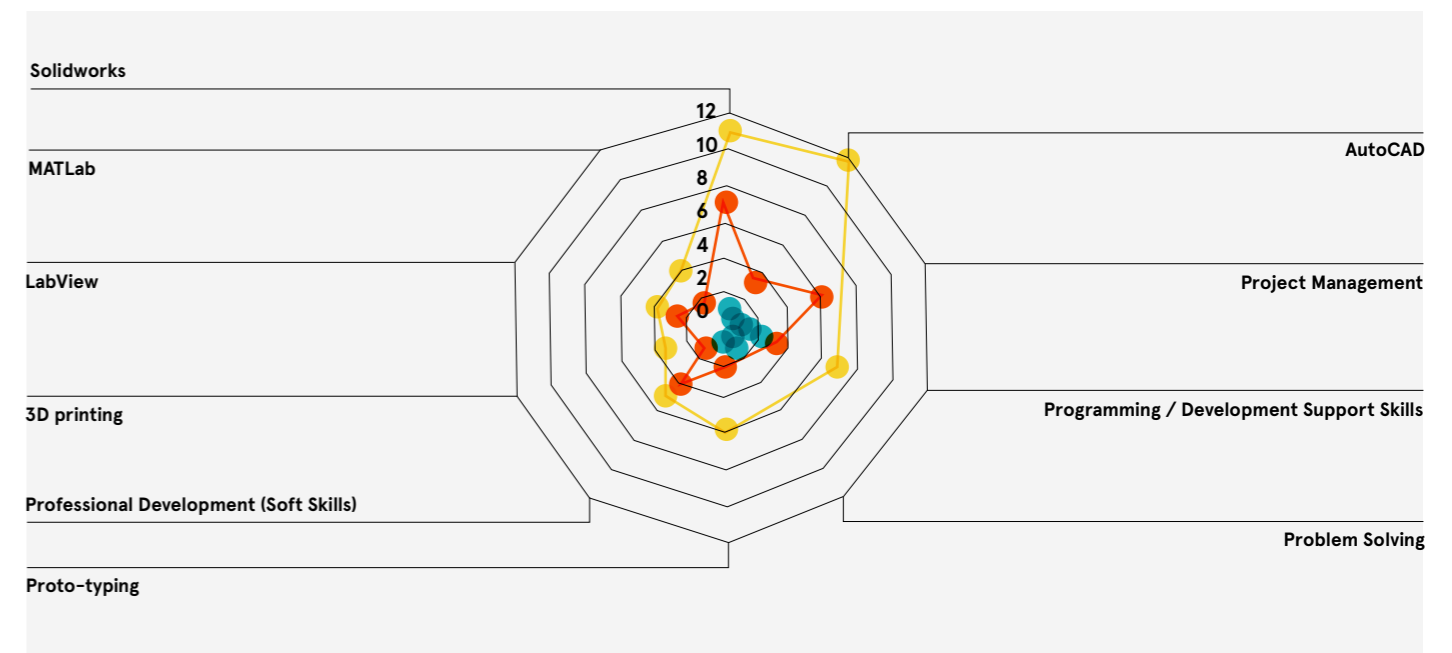


Rank	Entry Level	Competent Level	Expert Level
1	Welding	Soldering	Welding
2	Machining (Drilling, Milling, Turning)	Welding	Machining (Drilling, Milling, Turning)
3	Soldering	Machining (Drilling, Milling, Turning)	Soldering
4	CNC Machining	CNC Machining	CNC Machining
5	Sheet metalwork	Problem Solving	Sheet metalwork
6	Problem Solving	Project Management	Drawing
7	Laser Beam Machining	Professional Development (Soft Skills)	Problem Solving
8	Drawing	Sheet metalwork	Stamping

## Discipline 5: Design skills

In the Design Skills discipline, Solidworks is in demand across all levels. Demand for 3D printing and AutoCAD is applicable to entry level and thus a good addition to the above for those entering the sector. Transversal skills i.e. Problem Solving are included in the rankings for all levels.

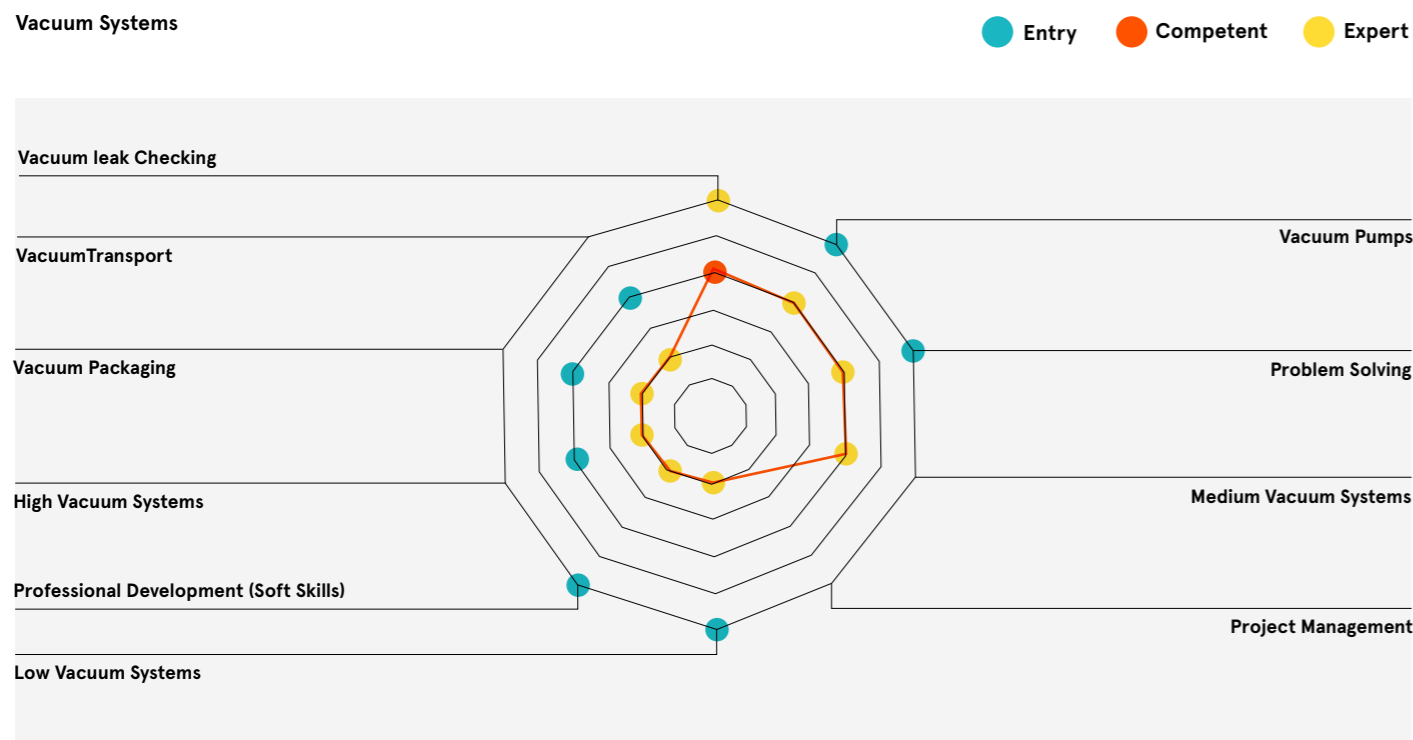
Design skills ● Entry ● Competent ● Expert



Rank	Entry Level	Competent Level	Expert Level
1	3D printing	Solidworks	Solidworks
2	Solidworks	Project Management	Proto-typing
3	Programming / Development Support Skills	Problem Solving	Material Strength
4	AutoCAD	Professional Development (Soft Skills)	Project Management
5	Project Management	AutoCAD	Programming / Development Support Skills
6	Proto-typing	Programming / Development Support Skills	Problem Solving
7	Problem Solving	LabView	Professional Development (Soft Skills)
8	Professional Development (Soft Skills)	Proto-typing	LabView

## Discipline 6: Vacuum Systems

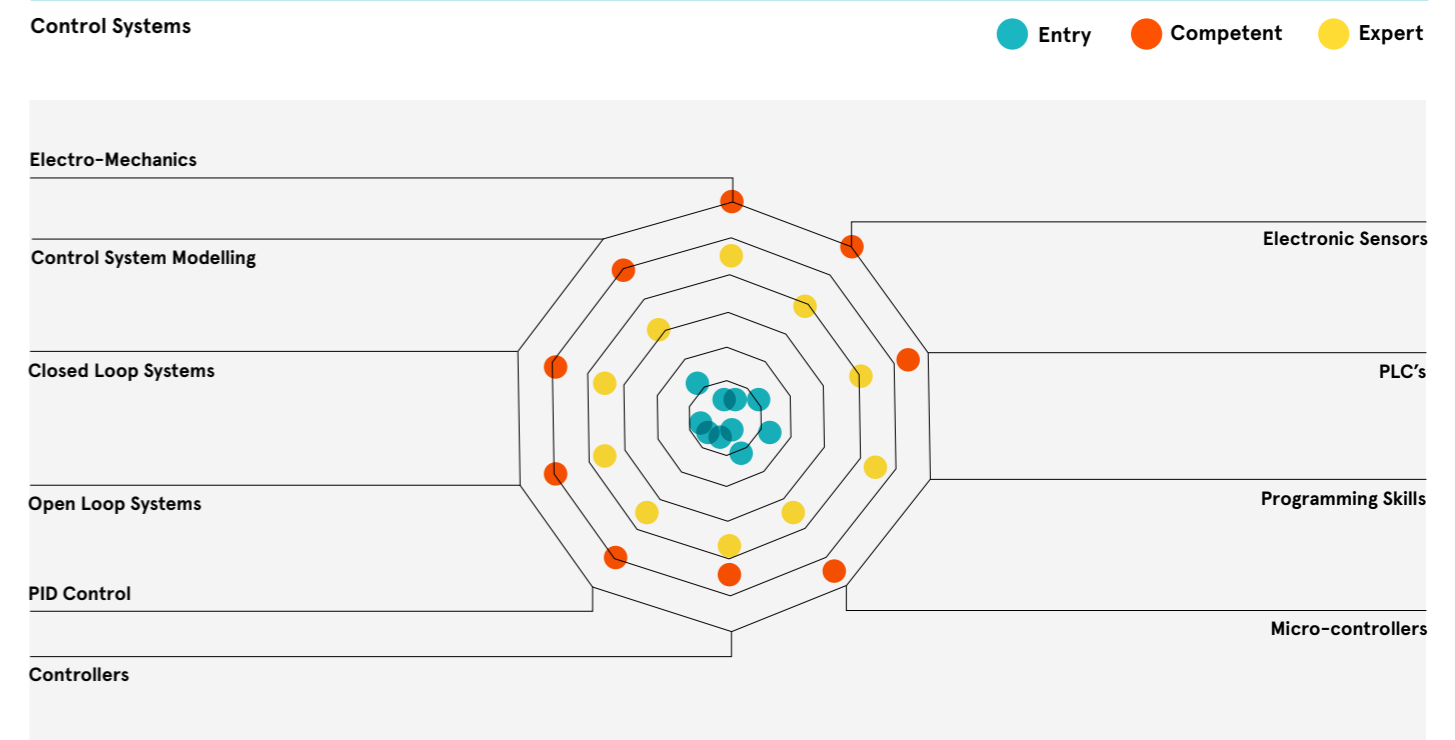
In the Vacuum Systems discipline, demand for Vacuum Leak Checking was highest at all levels. Following closely were skills in Vacuum Pumps and Problem Solving.



Rank	Entry Level	Competent Level	Expert Level
1	Vacuum leak Checking	Vacuum leak Checking	Vacuum leak Checking
2	Vacuum Pumps	Vacuum Pumps	Vacuum Pumps
3	Problem Solving	Problem Solving	Problem Solving
4	Low Vacuum Systems	Medium Vacuum Systems	Medium Vacuum Systems
5	Professional Development (Soft Skills)	Project Management	Project Management
6	Medium Vacuum Systems	Low Vacuum Systems	Low Vacuum Systems
7	Project Management	Low Vacuum Systems	Professional Development (Soft Skills)
8	High Vacuum Systems	High Vacuum Systems	High Vacuum Systems

## Discipline 7: Control Systems

Demand for PLC's is evident at all levels with most demand at entry. This combined with Programming Skills and knowledge of Controllers would be a strong entry-level skill set. Competency in Electro-mechanics and Electronic Sensors were particularly applicable to competence and expert levels.



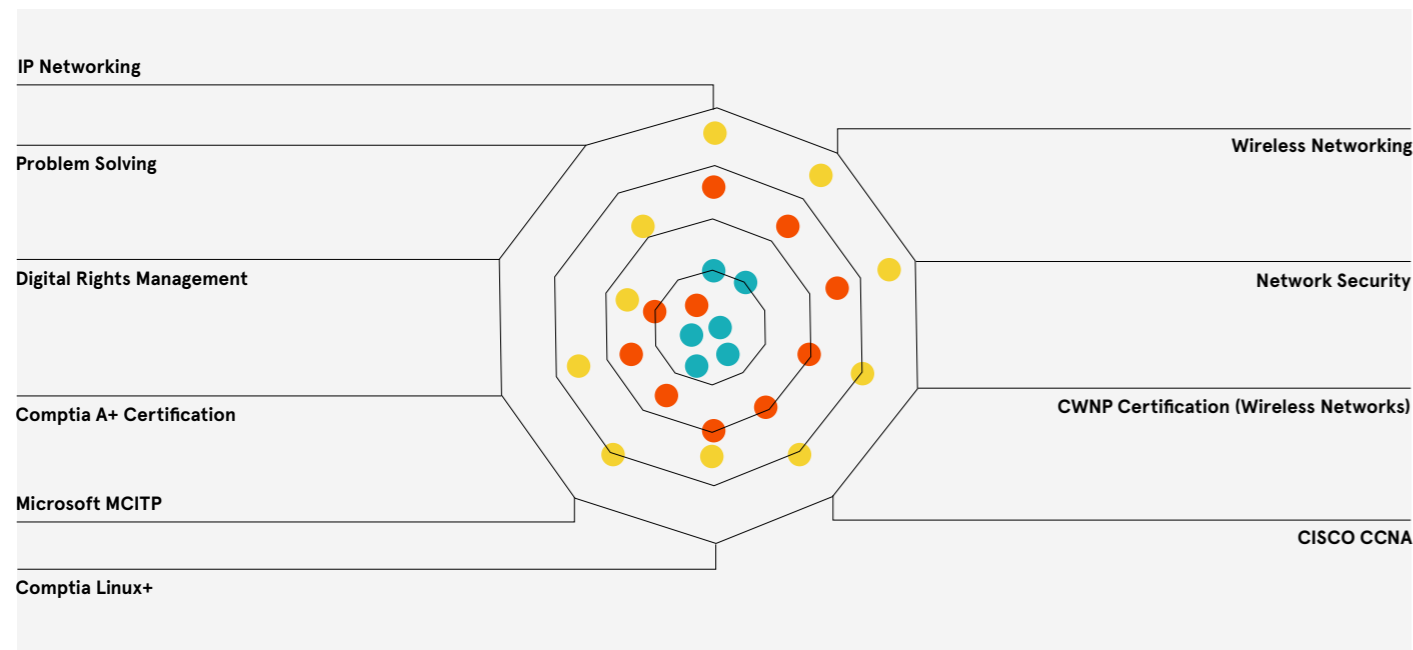
Rank	Entry Level	Competent Level	Expert Level
1	Programming Skills	Electro-Mechanics	Electro-Mechanics
2	PLC's	Electronic Sensors	Programming Skills
3	Controllers	PLC's	Electronic Sensors
4	Control System Modelling	Micro-controllers	PLC's
5	Electro-Mechanics	PID Control	Controllers
6	Electronic Sensors	Open Loop Systems	Micro-controllers
7	Micro-controllers	Closed Loop Systems	PID Control
8	PID Control	Control System Modelling	Open Loop Systems

## Discipline 8: Networking/PC Maintenance

In the discipline of Networking/PC Maintenance a set of fundamental skills are most needed. These include IP Networking, Wireless Networking, Network Security and CWNP (Wireless Networks) respectively across all levels.

Networking/PC Maintenance

● Entry ● Competent ● Expert



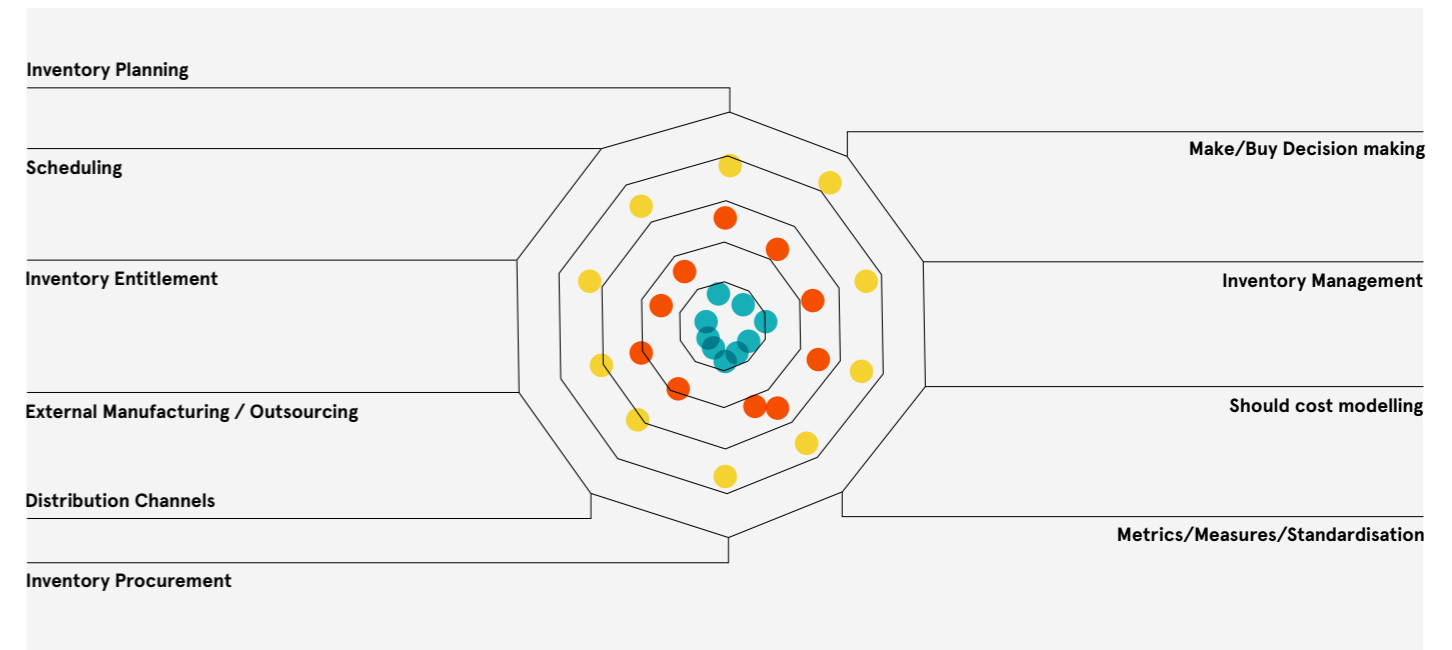
Rank	Entry Level	Competent Level	Expert Level
1	IP Networking	IP Networking	IP Networking
2	Wireless Networking	Wireless Networking	Wireless Networking
3	Network Security	Network Security	Network Security
4	CWNP Certification (Wireless Networks)	CWNP Certification (Wireless Networks)	CWNP Certification (Wireless Networks)
5	Comptia Linux+	CISCO CCNA	CISCO CCNA
6	CISCO CCNA	Comptia Linux+	Microsoft MCITP
7	Microsoft MCITP	Microsoft MCITP	Comptia Linux+
8	Comptia A+ Certification	Comptia A+ Certification	Comptia A+ Certification

## Discipline 9: Supply Chain Logistics

Inventory Planning is a high ranking skill for all levels. This combined with Inventory Management and Make/Buy decision making would give those at entry level a good grounding along with knowledge of Lean/Continuous Improvement.

Supply Chain Logistics

● Entry ● Competent ● Expert

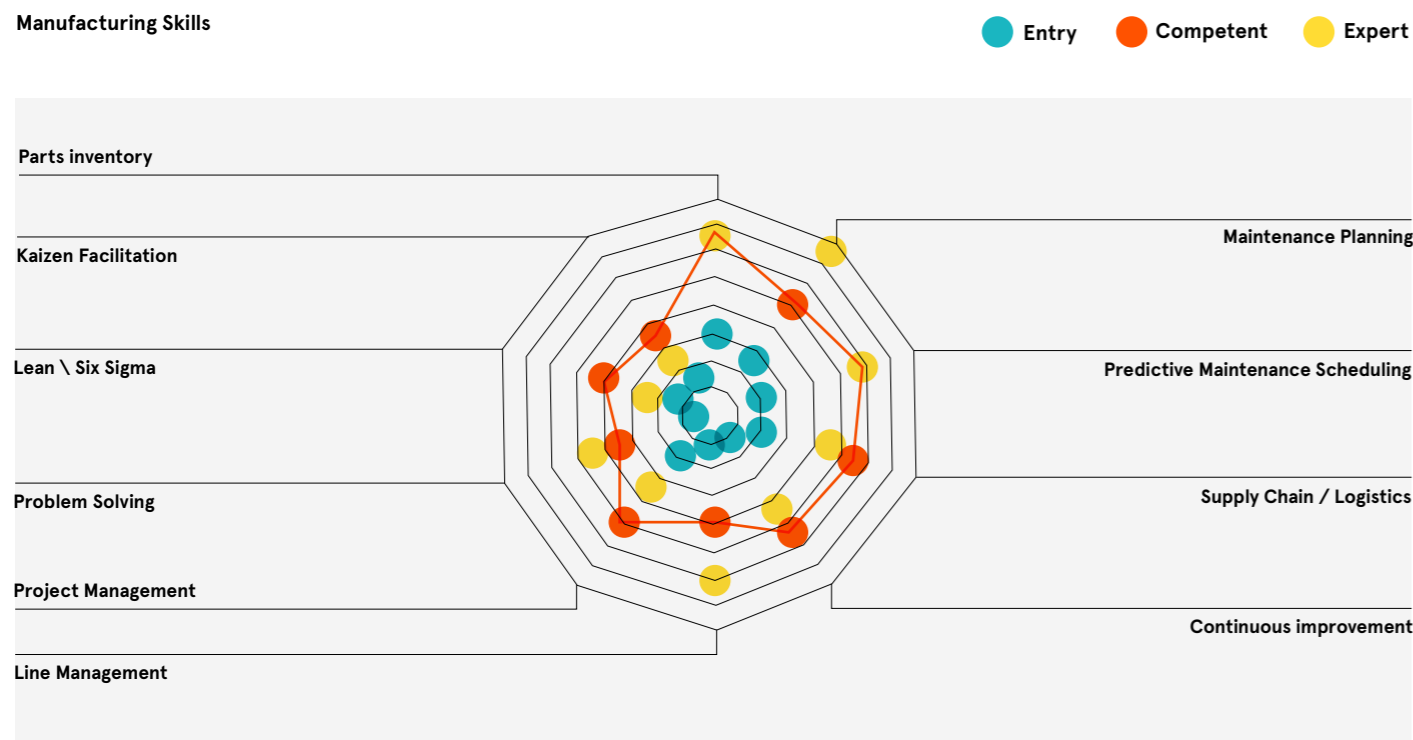


Rank	Entry Level	Competent Level	Expert Level
1	Inventory Planning	Inventory Planning	Make/Buy Decision making
2	Inventory Management	Should cost modelling	Inventory Planning
3	Make/Buy Decision making	Metrics/Measures/Standardisation	Inventory Management
4	Lean / Continuous Improvement	Make/Buy Decision making	Should cost modelling
5	Warehouse Management	Inventory Management	Metrics/Measures/Standardisation
6	Should cost modelling	Inventory Procurement	Inventory Procurement
7	Metrics/Measures/Standardisation	Distribution Channels	Inventory Entitlement
8	Inventory Procurement	External Manufacturing / Outsourcing	Scheduling



## Discipline 10: Manufacturing Skills

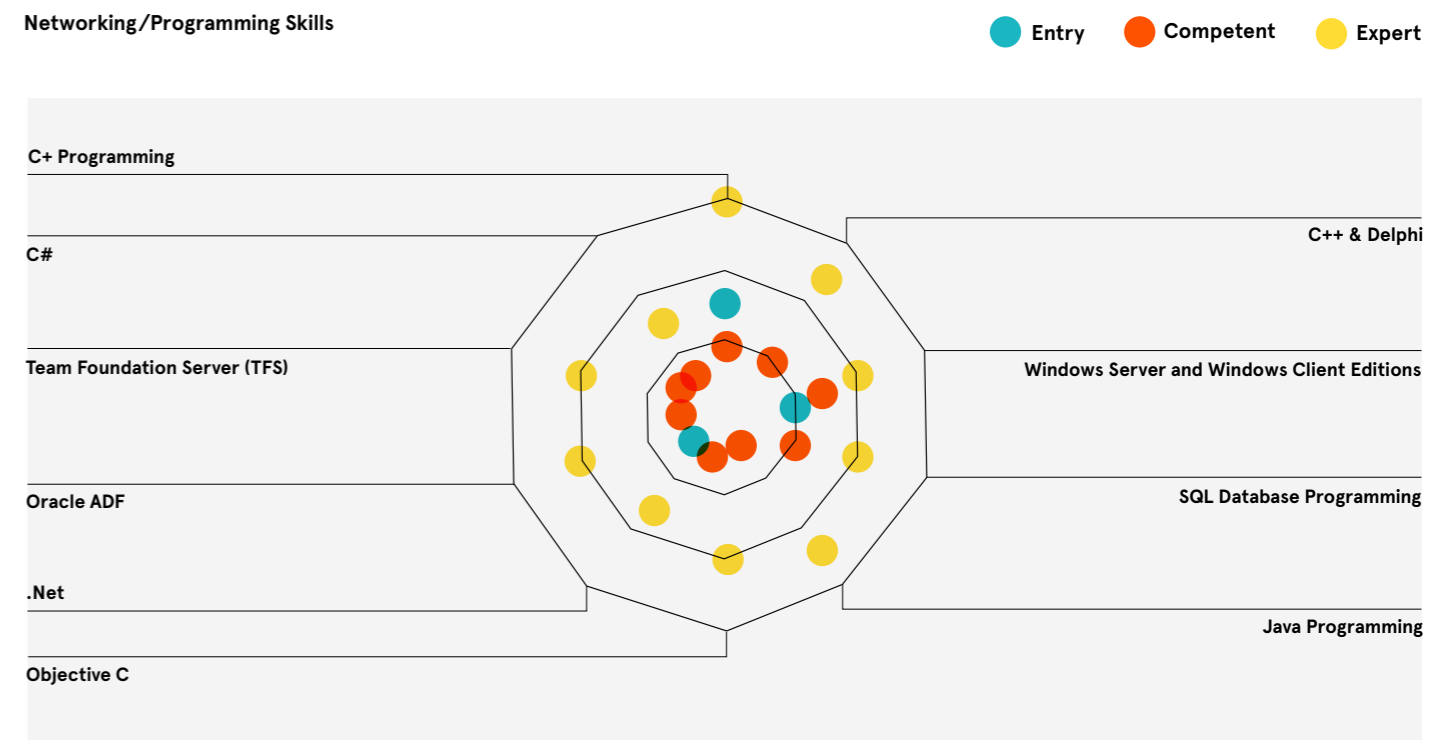
Skills in high demand in the Manufacturing Skills discipline are Parts Inventory, Maintenance Planning and Predictive Maintenance Scheduling. The addition of Supply Chain/ Logistics would be a strong skill set for those at entry level.



Rank	Entry Level	Competent Level	Expert Level
1	Parts inventory	Parts inventory	Maintenance Planning
2	Maintenance Planning	Predictive Maintenance Scheduling	Parts inventory
3	Predictive Maintenance Scheduling	Supply Chain / Logistics	Predictive Maintenance Scheduling
4	Supply Chain / Logistics	Continuous improvement	Line Management
5	Project Management	Maintenance Planning	Supply Chain / Logistics
6	Lean \ Six Sigma	Project Management	Continuous improvement
7	Kaizen Facilitation	Line Management	Problem Solving
8	Professional Development (Soft Skills)	Problem Solving	Project Management

## Discipline 11: Programming Skills

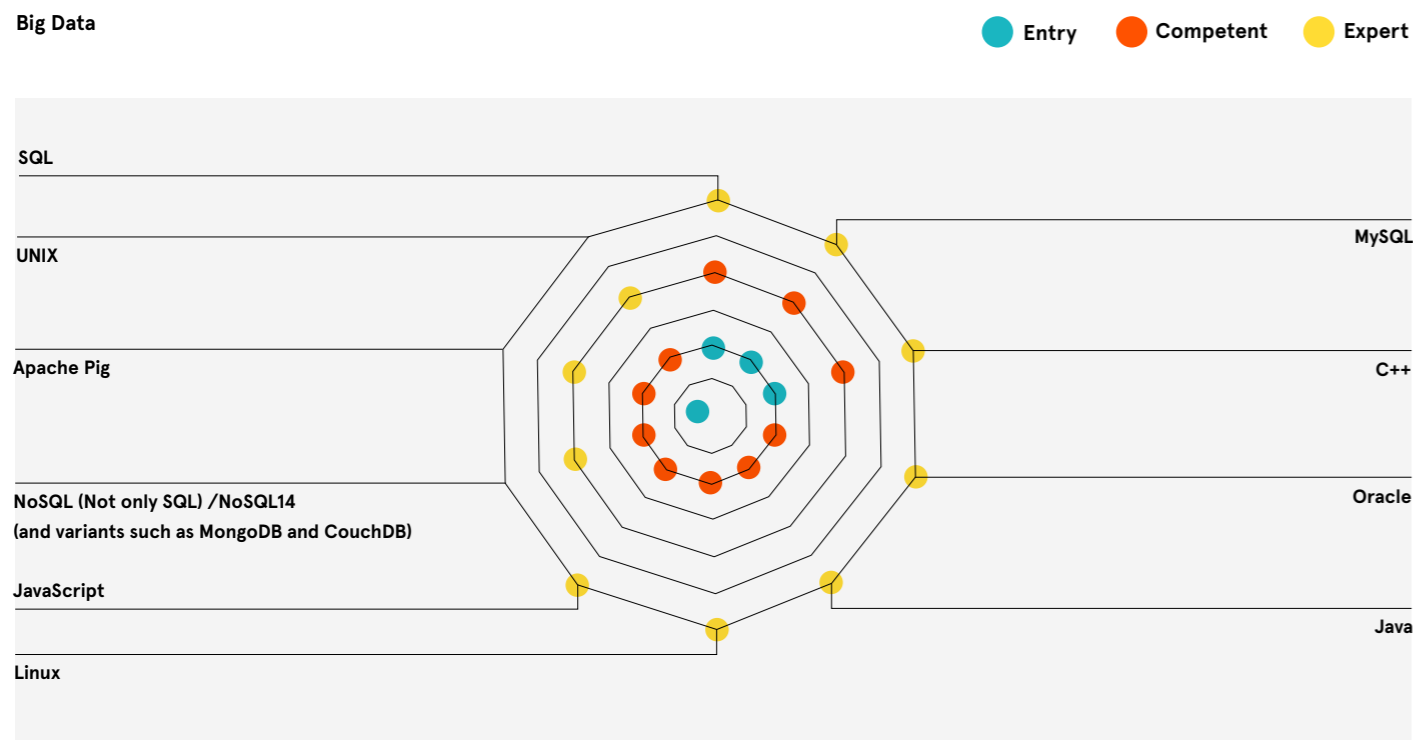
Three skills are identified across all levels within; C+ Programming, C++ & Delphi and Windows Server and Windows Client Editions. SQL Database and Java programming are also highlighted as important requirements and would provide a strong foundation for those at entry level.



Rank	Entry Level	Competent Level	Expert Level
1	C+ Programming	Windows Server and Windows Client Editions	C+ Programming
2	C++ & Delphi	C+ Programming	C++ & Delphi
3	Windows Server and Windows Client Editions	C++ & Delphi	Java Programming
4	SQL Database Programming	SQL Database Programming	Windows Server and Windows Client Editions
5	Java Programming	.Net	SQL Database Programming
6	Objective C	Java Programming	Objective C
7	.Net	Objective C	Oracle ADF
8	Oracle ADF	Oracle ADF	Team Foundation Server (TFS)

## Discipline 12: Big Data

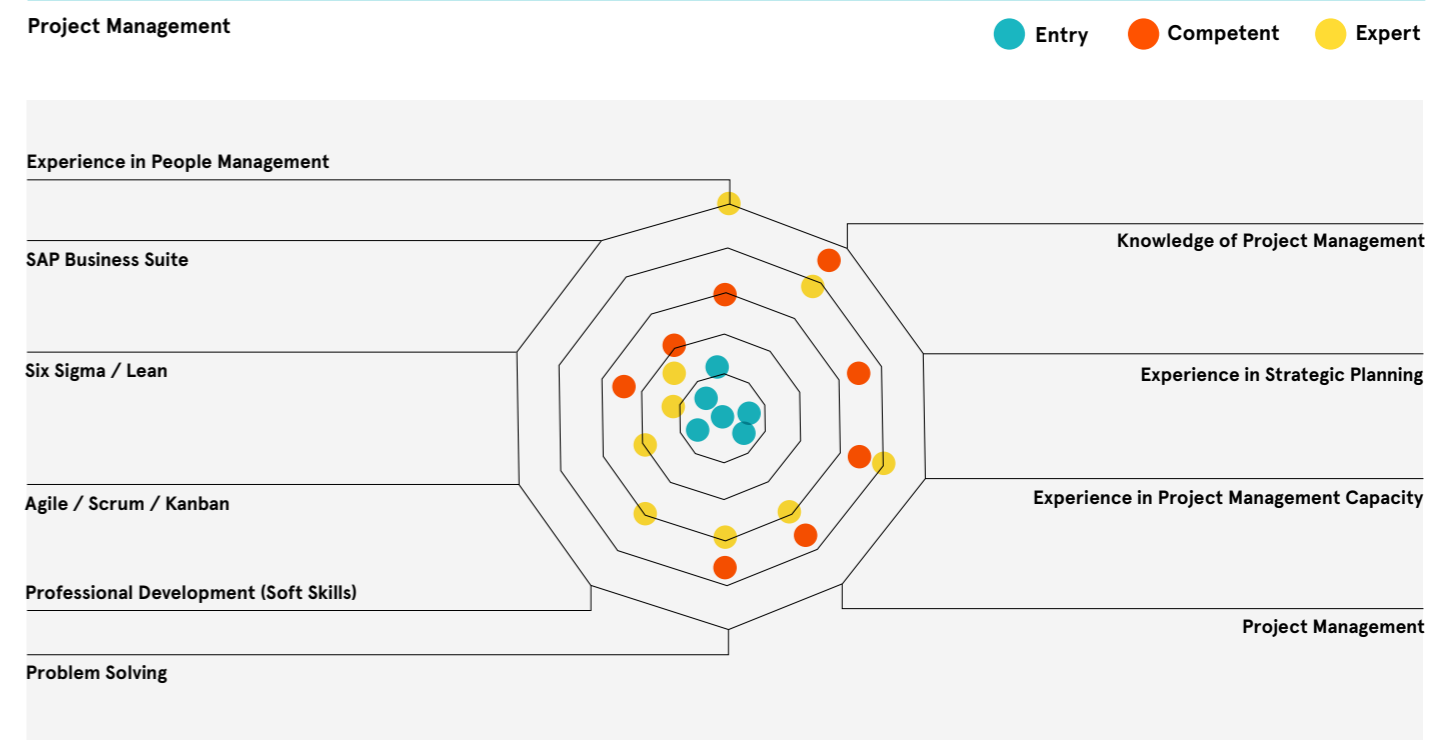
Skills in particularly high demand in the Big Data category are SQL, My SQL and C++. Interestingly, the top ranked skills for Big Data are the same at all levels thus developing such skills at entry level would be a good calling card for those entering the arena.



Rank	Entry Level	Competent Level	Expert Level
1	SQL	SQL	SQL
2	MySQL	MySQL	MySQL
3	C++	C++	C++
4	Oracle	Oracle	Oracle
5	Java	Java	Java
6	Linux	Linux	Linux
7	JavaScript	JavaScript	JavaScript
8	NoSQL (Not only SQL) /NoSQL14 (and variants such as MongoDB and CouchDB)	NoSQL (Not only SQL) /NoSQL14 (and variants such as MongoDB and CouchDB)	NoSQL (Not only SQL) /NoSQL14 (and variants such as MongoDB and CouchDB)

## Discipline 13: Project Management

In the Project Management discipline the most in demand skills are Experience in People Management combined with Knowledge of Project Management tools and techniques. Entry level Project Management skills would be enhanced with knowledge of Six Sigma/Lean and Agile/ Scrum/ Kanban.



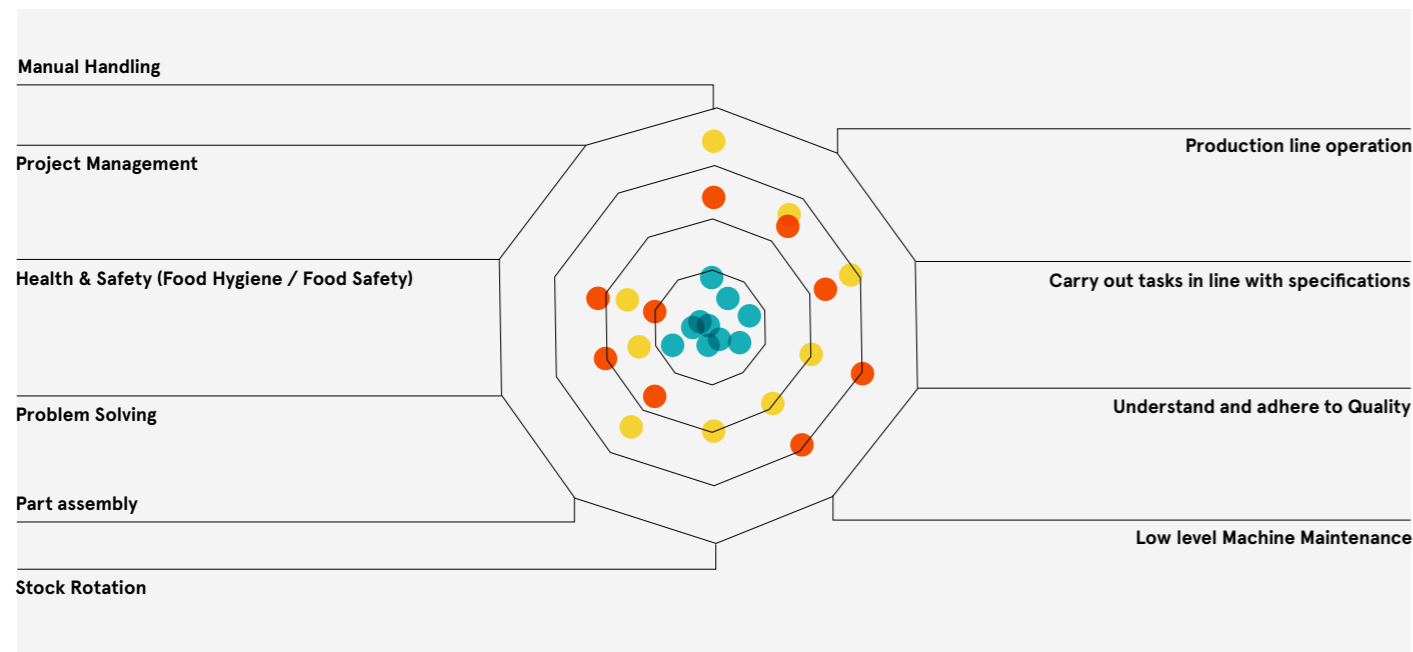
Rank	Entry Level	Competent Level	Expert Level
1	Experience in People Management	Knowledge of Project Management Techniques & Tools	Experience in People Management
2	Six Sigma / Lean	Experience in Strategic Planning	Experience in Strategic Planning
3	Experience in Strategic Planning	Experience in Project Management Capacity	Knowledge of Project Management Techniques & Tools
4	Experience in Project Management Capacity	Project Management	Experience in Project Management Capacity
5	Agile / Scrum / Kanban	Problem Solving	Project Management
6	SAP Business Suite	Professional Development (Soft Skills)	Problem Solving
7	PMP	Experience in People Management	Professional Development (Soft Skills)
8	Prince II	Six Sigma / Lean	Agile / Scrum / Kanban

## Discipline 14: General Operative Skills

In the General Operative Skills category, the strongest requirement was for Manual Handling. For those at entry level, this would be enhanced with skills in Production Line Operation and an ability to carry out tasks in line with specifications.

General Operative Skills

● Entry ● Competent ● Expert



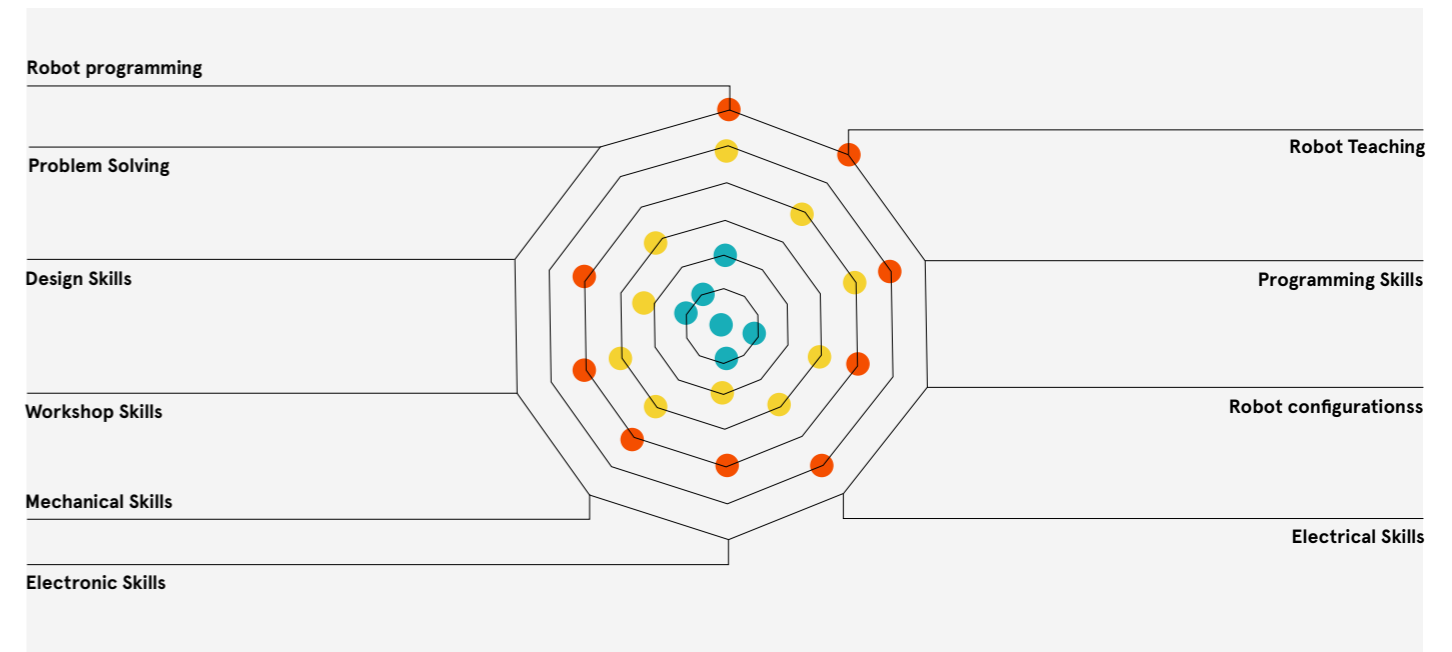
Rank	Entry Level	Competent Level	Expert Level
1	Manual Handling	Understand and adhere to Quality systems	Manual Handling
2	Production line operation	Low level Machine Maintenance	Production line operation
3	Carry out tasks in line with specifications	Manual Handling	Carry out tasks in line with specifications
4	Problem Solving	Production line operation	Parts assembly
5	Professional Development (Soft Skills)	Carry out tasks in line with specifications	Understand and adhere to Quality systems
6	Understand and adhere to Quality systems	Stock Rotation	Low level Machine Maintenance
7	Follow fault recovery flow charts	Problem Solving	Stock Rotation
8	Low level Machine Maintenance	Parts assembly	Dealing with customers

## Discipline 15: Robotic Skills

Demand for Robot Programming was ranked highest across all levels. Knowledge of Robot Configurations along with Design Skills would be a good foundation for those at entry level. Demand for Robot Teaching was strongest at competent level.

Robotic Skills

● Entry ● Competent ● Expert



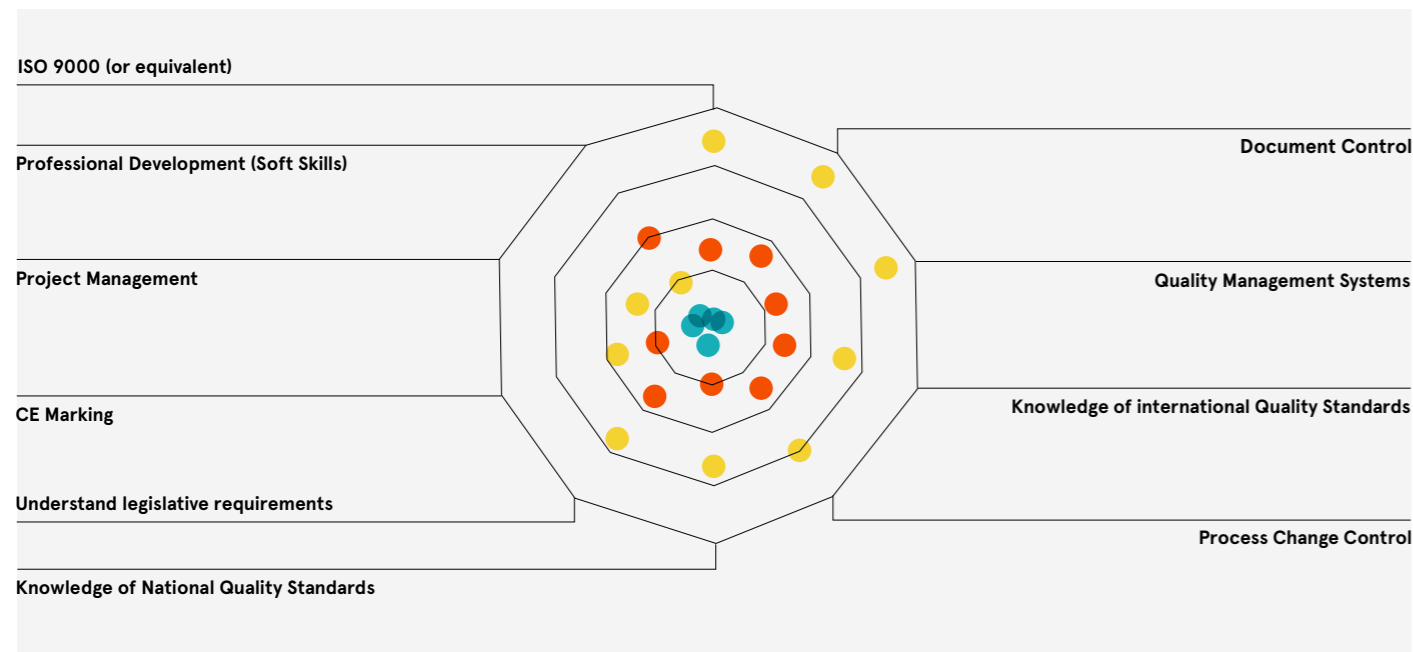
Rank	Entry Level	Competent Level	Expert Level
1	Robot programming	Robot programming	Robot programming
2	Robot configurations	Robot Teaching	Robot Teaching
3	Electronics Skills	Programming Skills	Programming Skills
4	Design Skills	Electrical Skills	Robot configurations
5	Problem Solving	Robot configurations	Electrical Skills
6	Professional Development (Soft Skills)	Electronics Skills	Mechanical Skills
7	Robot Teaching	Mechanical Skills	Workshop Skills
8	Programming Skills	Workshop Skills	Problem Solving

## Discipline 16: Quality Assurance Skills

The skill most in demand in the domain of Quality Assurance is Knowledge of National Quality Standards. While the majority of the demand is at competent and expert levels, Knowledge of International standards would prove fruitful for those at entry level.

Quality Assurance Skills

● Entry ● Competent ● Expert



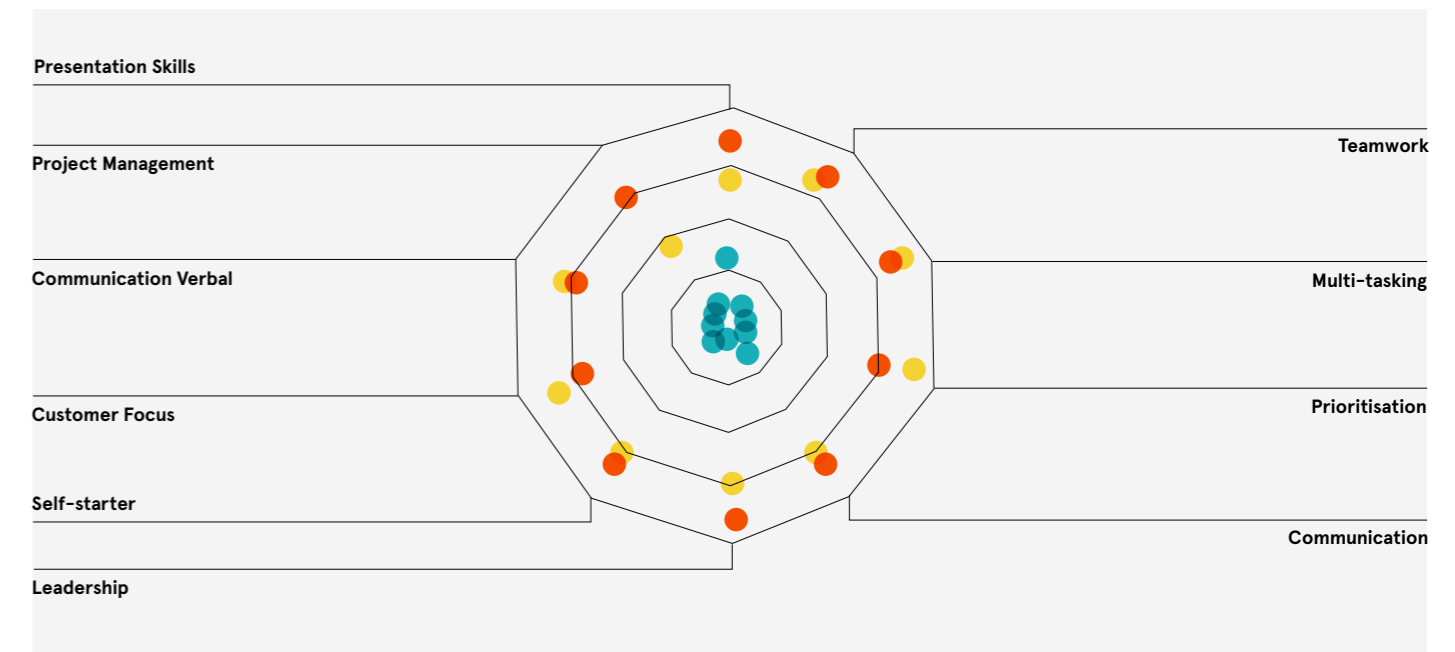
Rank	Entry Level	Competent Level	Expert Level
1	Knowledge of National Quality Standards	Professional Development (Soft Skills)	ISO 9000 (or equivalent)
2	Knowledge of International Quality Standards	Document Control	Quality Management Systems
3	CE Marking	Understand legislative requirements	Document Control
4	Project Management	ISO 9000 (or equivalent)	Process Change Control
5	None Cited	Knowledge of international Quality Standards	Knowledge of international Quality Standards
6	None Cited	Process Change Control	Knowledge of National Quality Standards
7	None Cited	Project Management	Understand legislative requirements
8	None Cited	Problem Solving	CE Marking

## Discipline 17: Professional Development

Presentation Skills and Written Communication were most in demand at entry level. Teamwork was cited as a requirement at all levels further enhanced by an ability to prioritise and multi-task. Although Leadership was highest ranked for competent level, the skill set required for competent and expert levels are similar overall.

Professional Development

● Entry ● Competent ● Expert



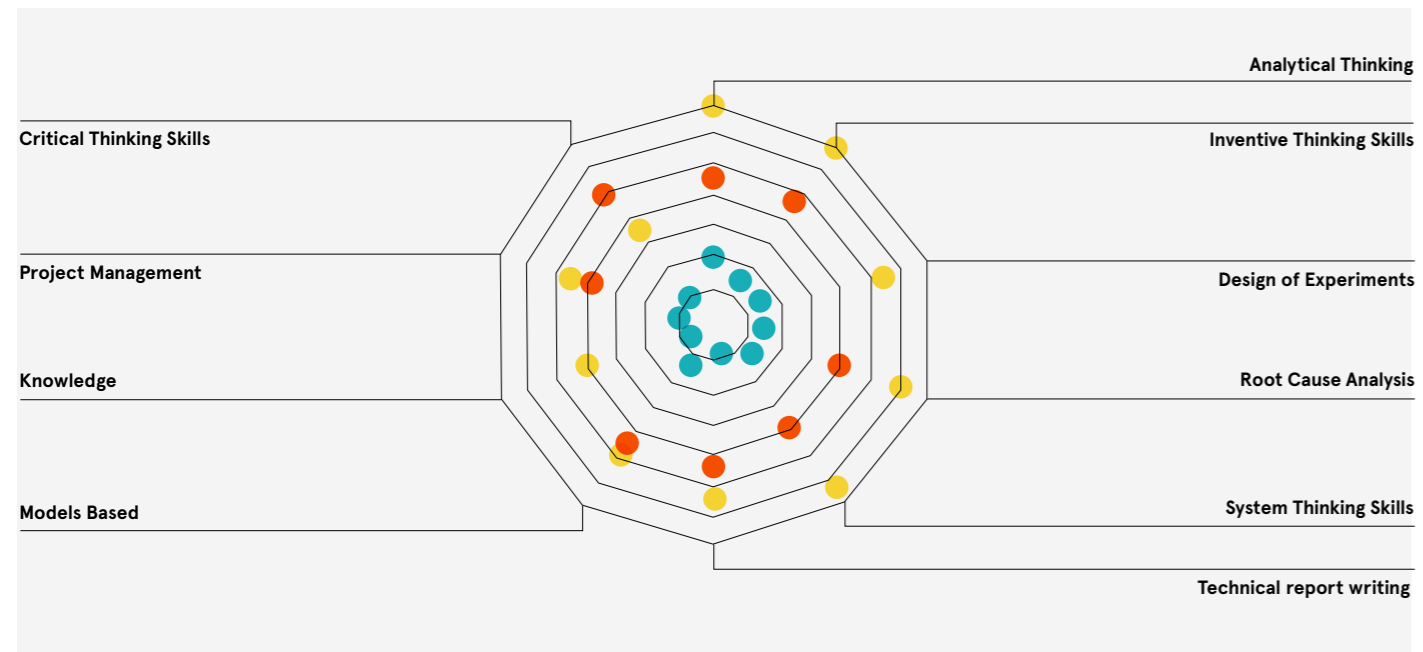
Rank	Entry Level	Competent Level	Expert Level
1	Welding	Soldering	Welding
2	Machining (Drilling, Milling, Turning)	Welding	Machining (Drilling, Milling, Turning)
3	Soldering	Machining (Drilling, Milling, Turning)	Soldering
4	CNC Machining	CNC Machining	CNC Machining
5	Sheet metalwork	Problem Solving	Sheet metalwork
6	Problem Solving	Project Management	Drawing
7	Laser Beam Machining	Professional Development (Soft Skills)	Problem Solving
8	Drawing	Sheet metalwork	Stamping

## Discipline 18: Problem Solving Skills

There was evident demand for those with Critical Thinking Skill in the category of Problem Solving. A combination of Analytical and Inventive Thinking Skills would strengthen ones competency at all levels.

### Problem Solving Skills

● Entry ● Competent ● Expert



Rank	Entry Level	Competent Level	Expert Level
1	Critical Thinking Skills	Inventive Thinking Skills	Critical Thinking Skills
2	Analytical Thinking Skills	Project Management	Analytical Thinking Skills
3	Inventive Thinking Skills	Soft Skills	Root Cause Analysis
4	Design of Experiments	Critical Thinking Skills	Design of Experiments
5	Root Cause Analysis	Analytical Thinking Skills	Customer Facing Skills
6	Technical report writing	Design of Experiments	Inventive Thinking Skills
7	Systems Thinking Skills	Systems Thinking Skills	Systems Thinking Skills
8	Models Based Problem Solving	Technical report writing	Technical report writing

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**Study Coordinated**

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Regional Skills Forum  
Manager, North West

