Talent to Thrive

The Future Skills Report for Ireland's Medtech Sector

2024 – 2028

Irish Medtech Skillnet

Irish Medtech Ibec

This report has been prepared by KPMG Ireland in collaboration with Irish Medtech Skillnet, Irish Medtech, and Skillnet Ireland.

Contents

01	Forewords	5
02	Executive Summary	9
03	Report Focus and Methodology	15
04	Medtech in Ireland: Skill Needs Analysis	21
05	Medtech in Key international Hubs	33
06	Future Skills Needs: Transversal and Digital Skills	45
07	Future Skills Needs: Research, Development, and Innovation	49
08	Future Skills Needs: Manufacturing	59
09	Future Skills Needs: Regulatory Affairs	69
10	Future Skills Needs: Sustainability	79
11	Future Skills Needs: Human Resources	89
12	Recommended actions, enablers, and conclusions	99
13	Appendix: - Acknowledgments - Survey Demographics - References	105

Glossary

AI: Artificial Intelligence

BPCI: BioPharmaChem Ireland

CAGR: Cumulative Annual Growth Rate

CAM: Computer-Aided Manufacturing

CAPA: Corrective and Preventative Actions

CE: Conformité Européenne

CFR: Code of Federal Regulations

CMO: Contract Manufacturing Organisation

CRO: Contract Research Organisation

CSRD: Corporate Sustainability Reporting Directive

CSO: Central Statistics Office

DEI: Diversity, Equity and Inclusion

DEI&B: Diversity, Equity, Inclusion and Belonging

EHDS: European Health Data Space

EHS: Environment, Health and Safety

EPO: European Patent Office

eQMS: Enterprise Quality Management System

ERP: Enterprise Resource Planning

ESG: Environmental, Social, and Corporate Governance

ETL: Extract Transform Load

ETO: Engineer To Order

EU: European Union

f: Forecast

FDA: Food and Drug Administration

FDI: Foreign Direct Investment

FTE: Full-Time Equivalent

GMDM: Global Medical Device Nomenclature

HCI: Human Capital Initiative

HCM: Human Centric Manufacturing

HEA: Higher Education Authority

HR: Human Resources

HRIS: Human Resources Information Systems

I.T.: Information Technology

ICT: Information and Communications Technology

IM: Irish Medtech

IMS: Irish Medtech Skillnet

IIoT: Industrial Internet of Things

ISO: International Standards Organisation

IT: Information Technology

IVD: In-Vitro Diagnostics

IVDR: In-Vitro Diagnostics Regulation

KPI: Key Performance Indicator

L&D: Learning and Development

LIMS: Laboratory Information Management Systems

MDR: Medical Device Regulation

MedDO: (Swiss) Medical Devices Ordinance

MES: Manufacturing Execution System

Mgmt: Management

ML: Machine Learning

MNC: Multinational Corporation

MSD: Merck, Sharpe, and Dohme

NIBRT: National Institute for Bioprocessing Research and Training

NFQ: National Framework of Qualifications

NHS: National Health Service

PLC: Programmable Logic Controller

PLM: Product Lifecycle Management

QMS: Quality Management System

QSR: Quality Systems Regulations

RD&I: Research, Development and Innovation

R&R: Repeatability and Reproducibility

RPA: Robotic Process Automation

SAAMD: Software As A Medical Device

SCADA: Supervisory Control And Data Acquisition

SME: Small and Medium Enterprise

SOP: Standard Operating Procedure

SPC: Statistical Process Control

STEM: Science, Technology, Engineering and Mathematics

TOPRA: The Organisation for Professionals in Regulatory Affairs

UAE: United Arab Emirates

UCC: University College Cork

UK: United Kingdom

UKCA: United Kingdom Conformity Assessment

US: United States of America

USP: Unique Selling Point

VR: Virtual Reality

XR: Extended Reality

YOE: Years of Experience

01 Forewords

On behalf of the Irish Medtech Skillnet I am pleased to present this comprehensive report focused on the current and emerging skills needs of Ireland's medtech sector.

The significance of the medtech sector in Ireland cannot be overstated, with over 450 companies and more than 48,000 individuals employed in its vibrant ecosystem. The landscape encompasses a diverse array of stakeholders, including large multinationals, small and medium enterprises (SMEs), and innovative start-ups, each contributing to the sectors resilience and adaptability. Central to our industry's strength is the exceptional calibre of its workforce, internationally recognised for its excellence. This reputation is testament to the outstanding upskilling and training development initiatives and associated national funding structures that underpin our workforce advancement across the island.

As the sector evolves, so too must our skill set and the way in which we deliver training. While established competencies such as automation and science-based skills remain vital, there is a growing demand for new and evolving skills which will impact on all activities of industrial processes and procedures. These evolving skills will be required to meet demands in areas such as data analytics, artificial intelligence, and sustainability. Furthermore, it is important to consider the changing mechanism by which training is delivered where micro-credentials and virtual reality have become part of the narrative associated with training and upskilling.

This report reflects our collective and collaborative effort to identify, benchmark and map which skills are valued and urgently needed by the sector, shaped by the input of over 400 individuals to our stakeholder consultations, numerous industry workshops and comprehensive surveys conducted both domestically and in international medtech hubs.

Our objective with this report is clear: to identify, qualify and quantify the skills requirement of Ireland's medtech sector through to 2028. Armed with this insight, the Irish Medtech Skillnet will develop industry-directed training programmes that address the identified skills gaps, ensuring the continued growth and prosperity of our industry and the fulfilment of our workforce's potential.

This report will support Skillnet Ireland's mission to help businesses in Ireland to be the best they can be, through innovative and enterprise-driven people development strategies. I extend my sincere gratitude to all those who contributed to this report and I am confident that this report will serve as a valuable resource for stakeholders across Ireland's medtech sector.

Dr. Ann O' Connell

Head of Funded Projects for Medtech and Engineering, Ibec

Ann O'Connell

On behalf of Irish Medtech, the Ibec group that represents the sector, it is my pleasure to introduce this report focused on identifying the future skills needs in the medtech sector in Ireland. This report is pivotal not only for supporting the sector presently but also for ensuring that Ireland maintains its status as a global best-in-class global hub for medtech.

As the international landscape of the medtech industry continues to shift and evolve, it is imperative that Ireland remains agile and adaptable. Enhancing our reputation as a global hub necessitates having the right skill set to navigate challenges such as new consumer demands, new technological innovations, changing business and regulatory models, emerging sustainable manufacturing, and eco-design methodologies.

This report represents the culmination of extensive stakeholder consultation across the medtech sector over the past 12 months and is underpinned by rigorous local and international research. Structured across five core skills pillars in medtech – Research, Development and Innovation, Manufacturing, Regulatory Affairs, Sustainability, and Human Resources – it provides a comprehensive understanding of the future skills landscape in our industry, as well as outlining recommendations to address emerging skills needs.

The insights gleaned from this research will be invaluable in helping Irish Medtech fulfil its broad focus of promoting and supporting the sustainable growth of our multinational and SME member companies.

Furthermore, this research will support the Irish Medtech Skillnet in the development of training programmes aimed at addressing identified skill gaps within the sector.

By identifying and addressing our sector's future skills needs, we can ensure that our industry remains at the forefront of innovation and excellence, and that Ireland retains its position as a global leader in innovative patient centred medical technology solutions.

Dr. Eoghan Ó Faoláin

Director, Irish Medtech

Eoghan Ó Faoláin

On behalf of Skillnet Ireland, I am delighted to present this comprehensive report commissioned to identify the future skills needs of medtech in Ireland. Skillnet Ireland recognises the pivotal role of the Irish medtech sector, with sectoral employment now reaching over 48,000. We understand that nurturing a diverse talent pool is essential for ensuring the continued growth and success of the ecosystem.

Ireland's international recognition as a centre of excellence for medtech is largely attributed to the availability of its highly skilled, adaptable, and flexible workforce. However, we must acknowledge that skill sets need to be continuously updated to keep pace with rapid innovation in the sector. It is imperative to "future-proof" the skill sets of the sector to meet the evolving demands of future medical devices and solutions.

This report, commissioned by the Irish Medtech Skillnet and supported by Irish Medtech, the Ibec group that represents the sector, offers a comprehensive view of the future skills needed in medtech to secure the sector's continued growth. The rich dataset and recommendations contained within this report present exciting opportunities to develop impactful upskilling initiatives that will ensure that the medtech sector can continue to thrive in Ireland.

I would like to extend my appreciation to all stakeholders across the medtech sector, academia, and adjacent industries who shared invaluable insights throughout the development of this report. I would also like to thank all the member companies who participated in the process, demonstrating their commitment to the advancement of the sector.

I encourage all stakeholders to carefully consider the findings of this report and take proactive steps to ensure that their workforces are equipped with the skills required to deliver future innovations in the medtech sector.

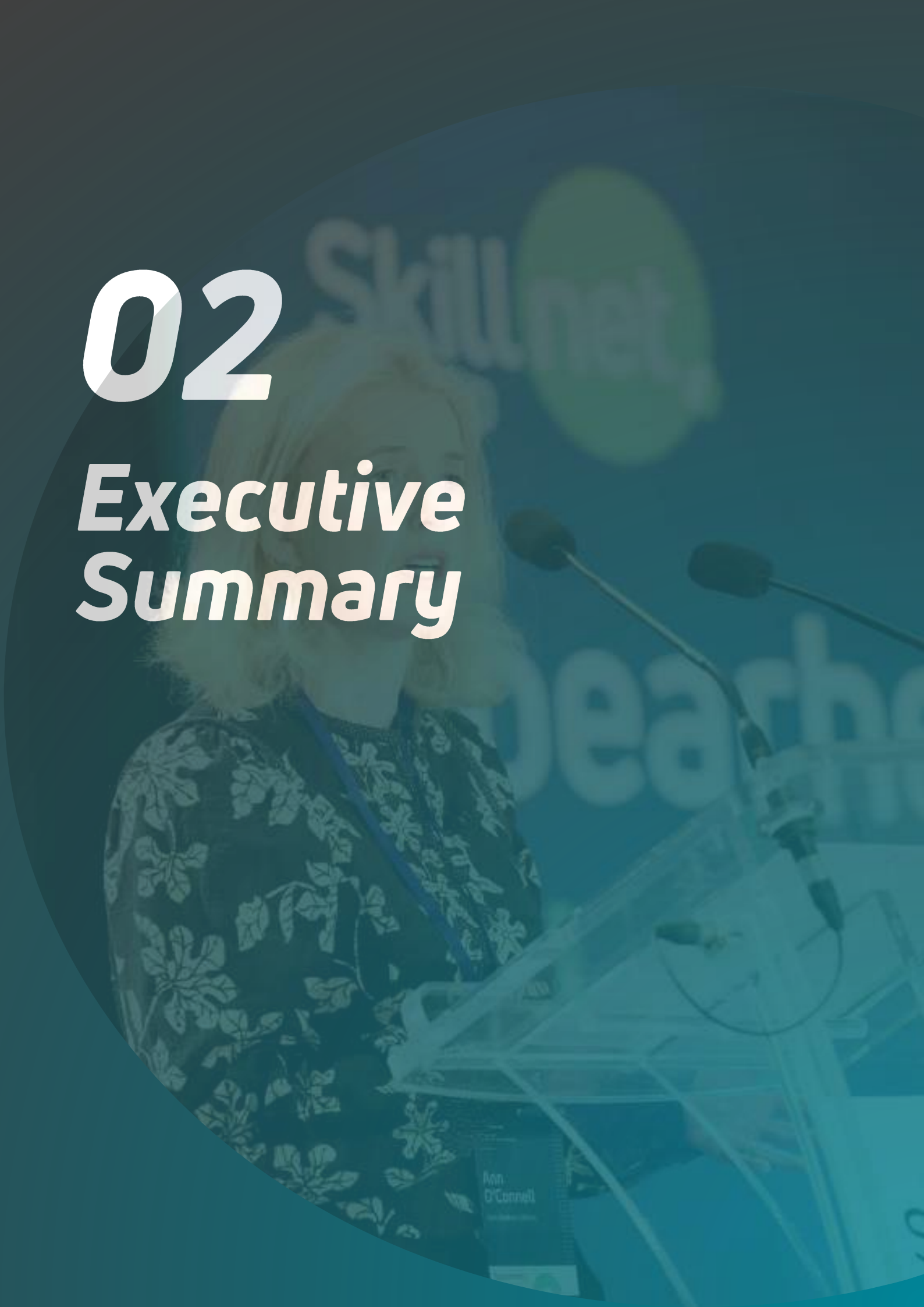
Together, let us continue to build Ireland's reputation as a best-in-class global hub for medtech.

Dave Flynn

Director of Business Networks, Skillnet Ireland

02

Executive Summary



Future Skills Needs in Medtech

This report set out to produce a framework to ensure Ireland further grows its status as a world-class medtech hub by producing a comprehensive future skills needs assessment for the Irish medtech sector, via insights from an extensive stakeholder consultative process, as well as from international trends shaping the skills agenda.

A future-proof workforce

The medical device sector is poised for growth over the next decade, with global annual sales expected to increase by €150bn between 2023 and 2028.[1] This growth reflects increasing demand for innovative new medical devices such as connected devices, autonomous surgical robots, intelligent balloon catheters and augmented reality assisted surgical tools, and will be supported through the transition to digitalisation and advanced manufacturing. In this context, this report was developed to capture current and future skills needs, forecast growth for the future, and delineate industry-approved solutions to skills needs.

Ireland's medtech sector is a global leader with a legacy of over 100 years of excellence. It employs over 48,000 people and produces a significant amount of the world's supply of critical medical devices such as stents and joint replacements.[6] A key element of the sector's success is the talent pool and diversified skill sets which exist here, fostered through an ecosystem which values collaboration and innovation, with a laser focus on patient impact.

Ireland, like other international hubs, is subject to significant global trends which are impacting the macro-economic landscape. Many of these trends, such as accelerated digitalisation, hyperconnectivity and the Industrial Internet of Things (IIoT), automation, artificial intelligence (AI), changing ways of working, the focus on sustainability and emerging regulations will have direct impacts not only on how the sector operates, but on the talent development and skills needs for the sector.

Our research and survey of Ireland's medtech workforce show the sector is expected to grow at a rate of ~3% annually to 2028, with faster growth predicted in specific functional areas such as Research, Development and Innovation (RD&I) (~7% annually), highlighting the need to equip this growing workforce with the skills necessary for continued success.

This report focuses on identifying the current and future skills needs of the Irish medtech sector across five functional areas: RD&I, Manufacturing, Sustainability, Regulatory Affairs and Human Resources (HR). Training needs are highlighted for each functional area individually to serve as a guide for skills requirements, and these functions and the skills needed often overlap.

RD&I serves as the innovation engine of medtech, and the precursor to commercial manufacturing, whilst regulatory affairs secures access to markets for new products and maintains the existing product portfolio. Human Resources (HR) and increasingly Sustainability, are interconnected across all functions, with the former operating to enable the overall success of the organisation, and the latter driving the sustainability agenda from the boardroom to the manufacturing floor.

Across functions, the sector has key skills needs in digitalisation, such as data analytics, visualisation and automation as well as an ability to leverage tools such as AI. Within RD&I, key skills including circular product design principles, novel packing technologies and personalised devices were identified as future skills needed for the function.

The functional areas of focus in this report:

Future Skills Needs in Medtech

As manufacturing shifts towards a digitised state, key skills needed for the future include adapting human-centric manufacturing principles, implementing digital twins and leveraging AI tools in manufacturing processes. In regulatory affairs, smart device products and regulatory knowledge of emerging global markets will drive the future skills agenda. HR and training departments are faced with the task of enabling the organisation to adapt to macro-trends, such as changes in the ways of working, and new skills training approaches. The HR function has key future skills needs in digital communication tools, leveraging novel training technologies such as virtual reality and enhancing the level of commercial acumen to deliver further impact. Finally, as the Sustainability function will be responsible for supporting the organisation's shift towards sustainable practices; key future skills needs include knowledge of Environmental, Social and Governance (ESG) principles, facilitating Corporate Sustainability Reporting Directive (CSRD) reporting and audits , alongside a knowledge of new technologies which can assist companies execute their sustainability goals.

Across all functions, transversal skills were highlighted as key current and future skills needs. These include an ability to problem solve, leadership, commercial acumen and strategic thinking. These are viewed as critical to equip individuals with the ability to work effectively in a modern organisation.

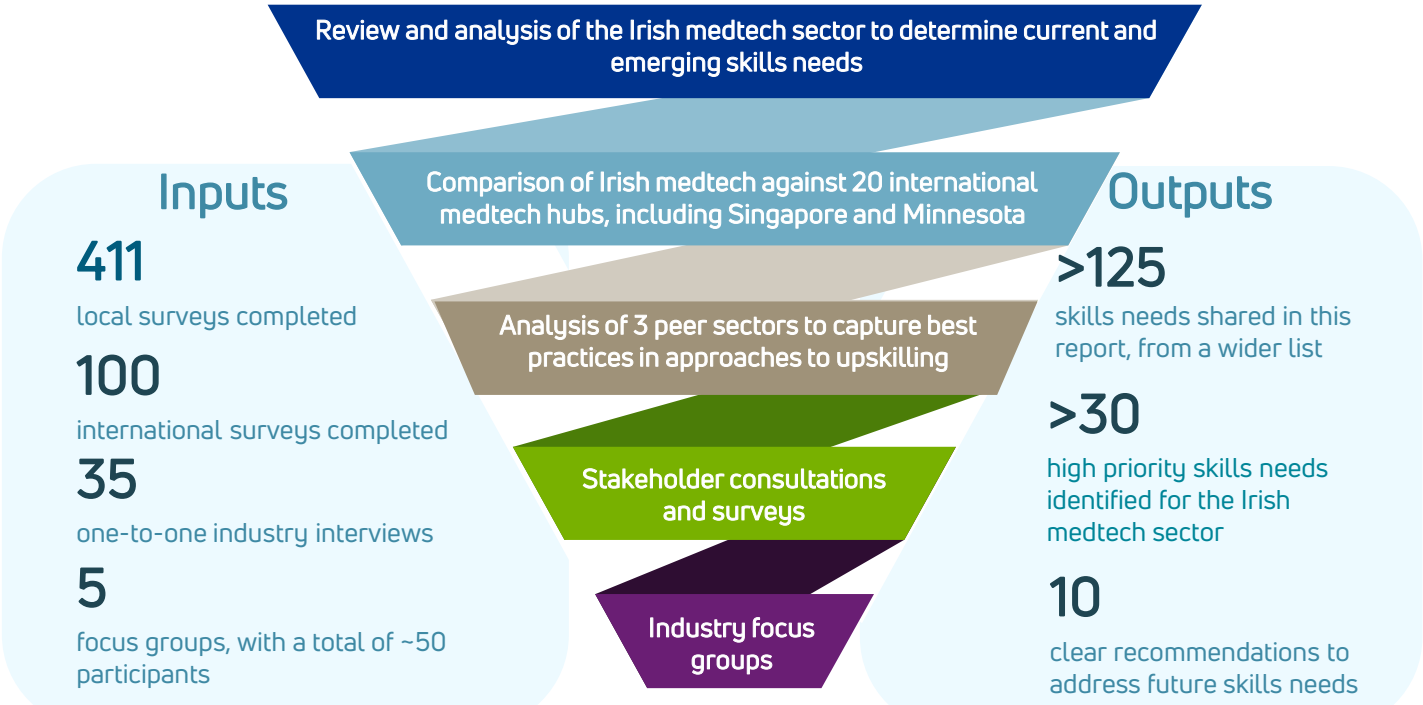
We see how medtech has adopted a hybrid mindset for training and upskilling, with workforce preferences shifting towards a blended approach to learning. Practical elements, industry-guided development and flexibility remain key priorities when evaluating training options.

International hubs are increasingly providing shorter training such as micro-credentialing and leveraging technology enabled tools for training, such as augmented and virtual reality (AR/VR), all of which provide key learnings for Ireland. This novel approach is proven internationally and will require an initial investment and upskilling to be successfully deployed at scale in Ireland.

Additionally, many key international medtech hubs are supporting the future skills needs of the sector through incorporating transversal skills training into more traditional technical training. Similar to Ireland, hubs such as Minnesota also describe advanced manufacturing training as urgently required, however, Minnesota provides in-company training in this area at twice the rate of Ireland, emphasising the need for Irish training rates to increase.

Overall, this comprehensive report provides a blueprint for the future skills needs within the medtech sector with the aim of ensuring that Ireland can maintain its position as a leading world-class medtech hub.

Methodology



Future Skills Needs in Medtech

High priority Macro skills

In addition to these 24 high-priority skills, an extended list of current and future skills needs per pillar are outlined in each corresponding results chapter. Chapters seven to eleven break down identified needs at a macro and meso skill level, identifying both broad skills needs and more specific skills within these.

Cross Function Summary Recommendations

Our key findings and recommendations are highlighted on the following two pages.

Research, Development and Innovation

Develop Smart Technology Expertise

All RD&I experts emphasised the high demand for smart technology skills, which will continue as devices become more connected and are used in a wider variety of both clinical and non-clinical settings.

Utilise Industrial PhDs to drive Innovation

Further scaling of the "industrial PhD" model will be an enabler to assist in building long term strategic collaboration between industry and academia to develop innovative healthcare solutions[a].

Train in Sustainable Innovation

Sustainability is increasingly important in RD&I; industry needs to prepare by training in areas such as sustainable design thinking, novel materials, and reusability.

Enhance Biomedical and Transversal Skills

As well as technical training in areas such as materials, there should be focus on basic biomedical knowledge, if not evident. For senior leaders, transversal skills to lead multidisciplinary teams are critical

Manufacturing

Advanced Digital and Automated Manufacturing Skills

The evolution towards advanced manufacturing continues to create skills needs in digitalisation and automation. Additionally, as the data infrastructure becomes further integrated within production and operations, skills needs are expected to grow in industrial cybersecurity, data warehousing, AI and data analytics.

Implement Virtual Training Solutions

Training for manufacturing must balance practical components while minimising impact on production. This could be achieved via a purpose-built centre or virtual reality training. On page 62 we provide a detailed example of a medtech company in Ireland, Freudenberg Medical, successfully implementing virtual reality training for operators.

Scaling Apprenticeships

Immersive learning models, such as apprenticeships should be embraced by both small and large organisations to nurture industry ready talent and embed transversal skills which are difficult to teach in a traditional classroom setting.

Sustainability

Implement Comprehensive Sustainability Training across the entire Organisation

To achieve company-wide sustainability metrics, two distinct approaches are required; short, high-level introductory training for all employees, alongside highly targeted technical training for project managers, supply chain experts, and regulatory professionals.

Develop Data-Driven Sustainability Skills

Sustainability initiatives rely on making informed decisions backed by data. As such, digital skills around data gathering, cleaning, storage, analysis and visualisation are crucial. Sustainability will permeate cross functional decisions over time enabled by digitalisation, creating a need for digital skills training with an ESG mindset.

Notes:

[a] In this context, the industrial PhD model refers to a graduate who is employed in industry and spends 1-2 days per week in an RD&I centre as a researcher in residence.

Cross Function Summary Recommendations

Human Resources

Empower HR with Digital Tools
Digitalisation courses providing a working knowledge of digital tools (e.g. HRIS) would drive efficiencies in organisational HR.

Expand HR's Strategic Role
Succinct, insight driven courses on functional areas outside of HR, as well as training on transversal skills such as problem solving, and commercial acumen would enable HR to further expand its role as a strategic influencer for the business.

Adopt Flexible Training Solutions
The HR function favours short and flexible training solutions. Repurposing content which is aimed at other functions in areas such as data analytics, could be an obvious first-step for medtech organisations.

Regulatory Affairs

Focus on Smart Device Regulations
The Regulatory Affairs function has emerged as a high priority skills need in smart devices, with future training needed in the AI Act.

Navigate Global Regulatory Landscape
The rise in importance of global markets such as India and China are driving the need for skills to navigate these overseas regulatory environments. As emerging markets become more attractive, similar skills needs will emerge in new jurisdictions.

Enhance Organisational Impact
An empowered Regulatory Affairs function can deliver additional organisational impact. Project management, leadership and data analytics skills training will enable those in a RA role to better influence cross-function decision making.

Cross-functional Transversal Skills Needs

Transversal skills were highlighted throughout our research and during focus group sessions as urgent skills needs across Ireland's medtech sector. These 'soft skills' are relevant at all levels and across all functions.

Leadership	Effectively organising and directing team members or individuals.
Project Management	Efficiently managing and progressing a project to successful completion.
Problem Solving	Analysing a problem in a structured manner and developing a solution.
Critical Thinking	Assessing a complex data set or situation where the problem is not immediately evident.
Commercial Acumen	Understanding business processes, markets, and financial matters.
Communication	Conveying information (verbal, visual) in an easily understood manner.
Strategic Thinking	Considering various factors and variables and developing clear plans of action.
Stakeholder Management	Creating and managing relationships both within and across organisations.

03

Report focus and methodology

The Focus of this Report

This report identifies, quantifies, and forecasts the skills needs of Ireland's medtech industry over the next four years, as well as capturing international trends impacting the skills agenda. Additionally, a series of industry-approved solutions for Ireland's skills challenges are proposed to secure future growth of the sector.

With nine of the top ten global medtech firms alongside a vibrant ecosystem of innovative start-ups and SMEs, Ireland provides an environment that enables medtech to thrive. To strengthen the sector's success and elevate Ireland's standing as a leading global medtech hub, where companies can design, develop and commercialise medical devices in a sustainable way, the Irish Medtech Skillnet and Irish Medtech sought to define the niche and multi-disciplinary future skills mix required by the sector.

This included the traditional skill sets associated with the medtech sector, such as automation and science-based skill sets as well as new and emerging skills such as advanced data analytics, AI and eco-product design principles.

The primary aim of this report is to identify, quantify, benchmark and project the skills requirements of Ireland's medtech sector over the next four years, to 2028. The report's secondary aim is to develop and test a number of industry-approved solutions to Ireland's current and emerging training needs in the medtech sector.

The primary objectives of this report are as follows:

1. Assess the adequacy of current skills within the Irish and international medtech sector, highlighting local and global skill challenges.
2. Define the profile and diversity of skills required for a world-class medtech talent pool, projecting these needs through to 2028.
3. Assess the changing means by which skills training is delivered and provide updates on international best practices and responses to common trends in medtech.
4. Provide expert insights into current and future skill requirements for medtech and gather best practice examples for enhancing sector skill levels.
5. Inform the development and implementation of industry-driven and grant-funded training programmes aimed at addressing identified skill gaps, facilitated by the Irish Medtech Skillnet and other collaborative partners.

This report covers both medical devices and in-vitro diagnostics, from all 16 categories of the Global Medical Device Nomenclature (GMDN) system and their associated research, development, manufacture, and commercialisation.

Although digital skill sets are noted throughout this report, the digital health aspects of medtech were not in scope. These relate to software as a medical device and data-driven connected health technologies with applications across medtech and has been the focus of a recent report by the Connected Health Skillnet on cross-sectoral digital health opportunities for life sciences, entitled "*Where Digital Health Thrives*".[2]

Another hybrid sector segment not in scope for this report is advanced drug delivery, combining medical technologies, biochemistry and drug delivery systems, although many of the findings of this report will be relevant to both.

"Everyone is talking about digitalisation, automation, big data, AI. But when it comes to roles, and to skills – we are short on everything, every skill."

Senior Medtech Executive

"We are competing for talent, yes. But I believe we all put on the green jersey when it comes to developing our sector and making Ireland a global leader."

Senior Medtech Executive

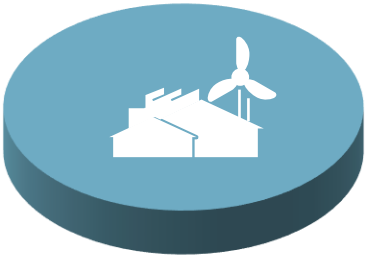
Skills Pillars

We've structured our analysis around five distinct functional skills pillars in medtech which are aligned with key functions in the sector, each highlighting unique skills demands.

01

Research, Development and Innovation (RD&I)

RD&I serves as the engine of innovation in medtech, driving the creation of novel products that enhance patient outcomes. These professionals are integral for new product development from concept through to commercialisation. Their ability to collaborate cross functionally with internal and external stakeholders is critical for the continued growth of the medtech sector.



02

Manufacturing

Manufacturing comprises the bulk of the Irish medtech sector workforce and is facing critical challenges around adapting to an automated, digitised future, while ensuring existing production levels are maintained. Professionals working here vary from highly technical operations to strategic manufacturing process oversight and management.

03

Regulatory Affairs

Medtech, as one of the most highly regulated sectors, has ongoing skill needs in the regulatory affairs function. These professionals navigate the complex regulatory landscapes in national and international markets, to guide and influence organisations strategic commercial decisions and lobby government agencies and associations for sector-wide needs.

04

Sustainability

As the ESG focus increases over the coming decade, in line with incoming regulations, the need for eco-friendly and ethically designed, sustainable products will also increase. While the entire workforce will need to embrace a sustainability mindset, a targeted number of professionals will require expertise to guide and implement strategic sustainability practices and processes.

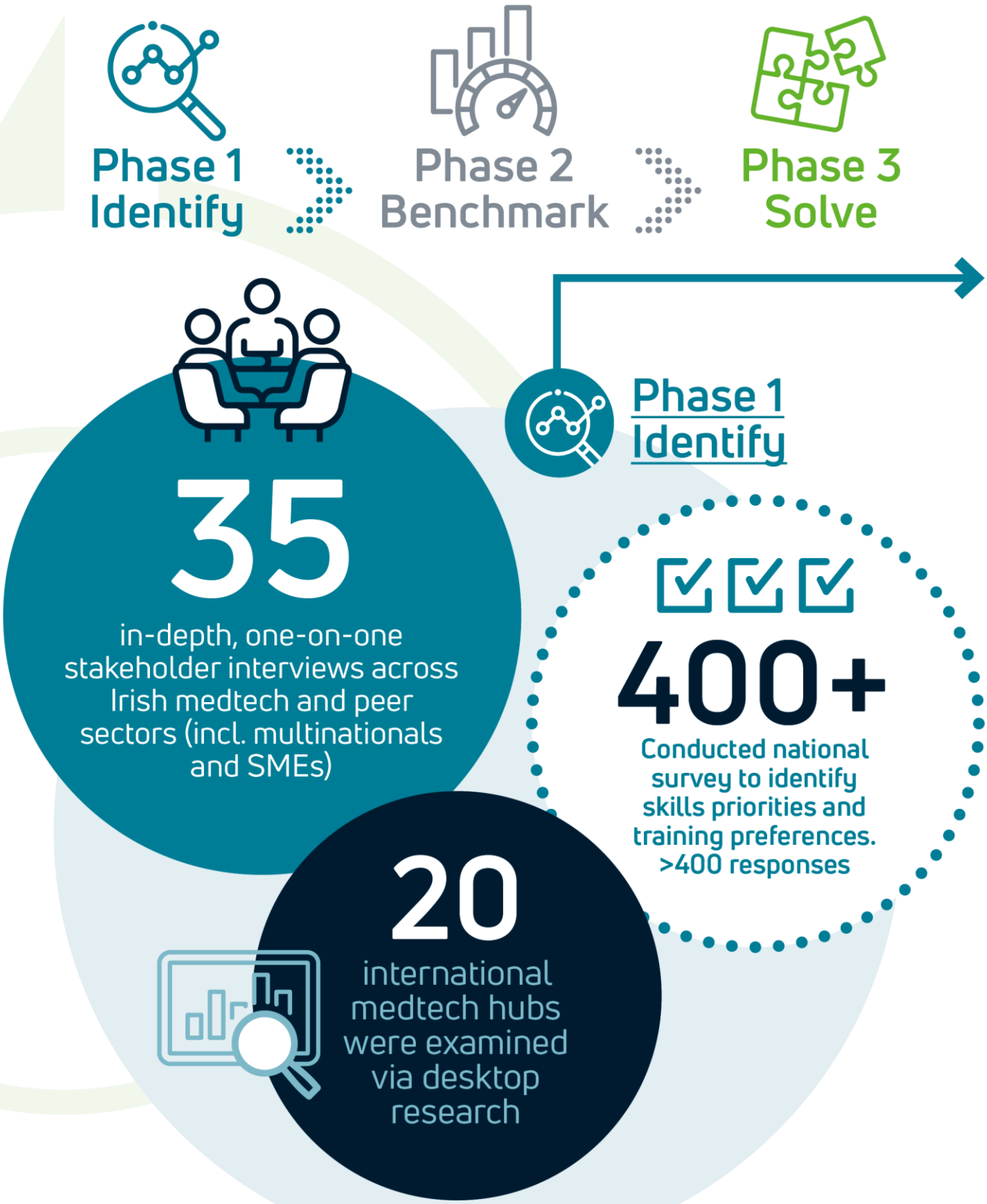
05

Human Resources (HR)

As in all sectors, HR plays an influential cross-functional role in medtech, overseeing the recruitment and development of essential talent. These professionals not only need to grapple with changing workforce preferences, but the function is itself being transformed, requiring a high level of digital literacy to support technology advancements. As work practices evolve, HR will need to be agile in adapting to emerging skills needs.

Methodology

We assessed current and future skill requirements in the medtech sector through industry interviews, comprehensive desktop research, local and international benchmarking surveys, and five industry focus groups to gain deeper insights from interviews and survey responses



5 international medtech hubs

3 peer sectors

BioPharma

Food Tech

Technology

Phase 2 Benchmark

2 international medtech hub surveys – Singapore and Minnesota – with 50 respondents each

Phase 3 Solve

Collated all findings into a comprehensive report to map the future skills needs of the medtech sector

50 medtech experts participated in function-orientated focus groups across the 5 identified pillars, to identify high priority skills needs

Identified preliminary

FUTURE SKILLS

requirements and defined high-level solutions based on survey responses

Survey of the Irish Medtech Sector

A pivotal aspect of this research involved conducting a survey to amplify the voice of the Irish medtech sector. Greater than 400 individuals participated in our survey, providing critical insights on current and future talent development needs. Complimentary international medtech hub surveys were also carried out in Singapore and Minnesota*.

Survey content

Comprehensive survey questions were crafted in collaboration with industry experts through a series of workshops, with the aim of collecting essential data to shape forthcoming skills programmes.

Beyond the 411 respondents in Ireland, subsequent surveys conducted overseas gathered insights from 50 respondents in Singapore and another 50 in Minnesota.

Data capture occurred over the period of September 2023 to February 2024. Key survey topics included:

1. **Estimated headcount and growth by function**
2. **Skills needed and relative urgency**
3. **Preferences to different training approaches**
4. **Recommendations to address skills needs**

Irish medtech survey respondents

In total, 411 Irish respondents completed the survey, making this the most comprehensive industry skills needs analysis completed in the sector in Ireland. The breakdown of respondents by function, seniority, company size, and location in Ireland is shown below:

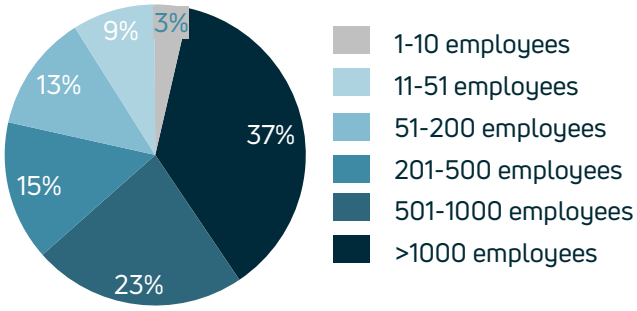
By function

- 20% Regulatory & Quality
- 16% Manufacturing
- 12% Engineering
- 12% RD&I
- 11% HR
- 29% Other functions

By seniority

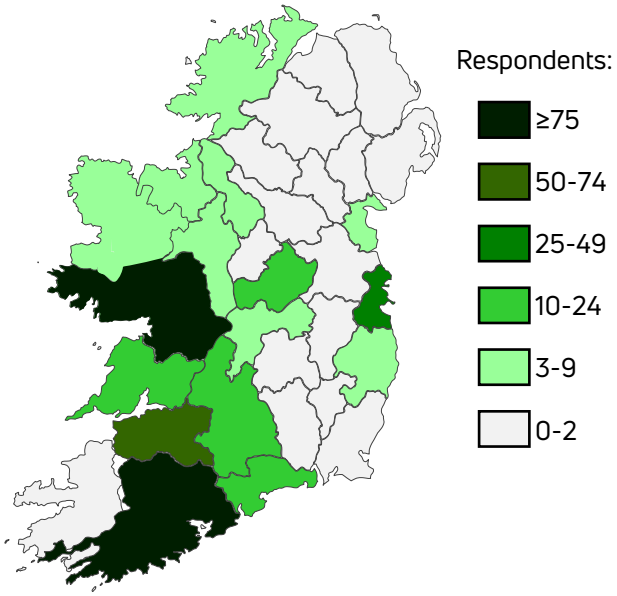
- 18% Executive Leadership
- 16% Business Unit Lead
- 29% Senior Manager
- 24% Manager
- 11% Mid-level
- 2% Entry level

By company size in Ireland



Aligned with Ireland's overall employment trends, the majority of respondents were from multinational corporations, while over 100 respondents represented small and medium-sized enterprises (SMEs). This ensured the perspectives of both large-scale enterprises and smaller businesses across the island of Ireland were effectively captured.

By geography



Our survey followed the general distribution of medtech companies in Ireland, with the highest concentration of respondents clustered in the regions of Cork and Galway, followed by high representation from Limerick, Dublin, and Westmeath.

Notes: [*] Singapore and Minnesota survey demographics can be found in the Appendix.

04

Medtech in Ireland: Skills needs analysis

Medtech in Ireland

With a legacy of over 100 years of excellence, Ireland's medtech sector is a cornerstone of the economy. With Europe's highest medtech employment per capita and its largest trade surplus, Ireland is a pivotal global supplier meeting extensive demand.

The industry in an international context

The medtech sector is one of Ireland's major success stories, composed of a healthy mix of MNCs, start-ups, and SMEs, with SMEs making up approximately 80% of all medtech companies in Ireland. The Irish sector stands out globally, with Europe's highest per capita direct employment in medtech at 89 per 10,000. This is 15% higher than Switzerland's 77 per 10,000, and more than double that of all other European countries.[3]

The Irish medtech sector is a globally recognised success, with many medtech companies operating multiple sites across the island, demonstrating Ireland's ability to attract and retain these global organisations, as well as nurture and grow indigenous companies. A key aspect of the sector's success is the rich *talent ecosystem* which exists locally to support these companies. This ecosystem has been developed by organisations providing in-house training programmes, world-class further & higher education institutions and third-party providers offering a range of medtech courses both online and in-person. The Skillnet Ireland model is an example of a novel approach to developing and delivering industry-led training programmes. It has been recognised by the European Commission as a global leading skills training model for its impact on businesses and contribution to the economy.[4] To retain its leadership position, Ireland's medtech workforce will need to adapt its skill sets in response to international trends shaping the sector currently, while educators and training providers will need to develop future focused training programmes which respond to these shifts.[5]

Sector at a glance

~450
medtech companies in Ireland, employing over 48,000 people.[6]

€16bn
Exports in 2022, third behind the much larger nations of the Netherlands at €40bn and Germany at €32bn.[3] Ireland also boasted Europe's highest medtech trade surplus in 2022, at €13bn.[3]

9/10
Of the world's largest medtech firms have operations in Ireland.

80%
Of the worlds stents are produced in Ireland, alongside 75% of replacement knees and 33% of contact lenses.

135
European Patent Office patents granted to Ireland in 2023, making this Ireland's leading patent field at 22% of all Irish patents.[7]

"Ireland's unique selling point (USP) is its mixture of skills; it easily has one of the best mixed skills workforces. By the time people are in senior roles they understand most functions, and that's rare and valuable, globally."

Senior Medtech Executive

Ireland's Unique Selling Points

Ireland stands out as an appealing destination for medical device companies due to its collaborative ecosystem, talented human capital, geographic and strategic incentives, making it a top choice for medtech investment and innovation.

01

Skills to succeed and a legacy to match

Ireland's proven track record in attracting foreign direct investment (FDI) in medtech and high levels of tertiary education have created a rich pool of talent for new market entrants, alongside a supply of experienced industry innovators who have the potential to form spin-out and start-up companies.

02

Streamlined collaboration

Ireland's medtech ecosystem fosters collaboration, connecting industry with academia, research centres, innovation programmes, and training providers. Government funded initiatives such as BioInnovate Ireland, Health Innovation Hub Ireland and DigiBio help to drive research and clinical applications, while the Irish Medtech Skillnet has developed and delivered training to thousands of learners across hundreds of industry-led programmes by collaborating extensively with both industry and academia.[8]

03

Innovation which is nurtured

Ireland offers a wide range of financial incentives, such as grant-aided feasibility studies and research grants, as well as an attractive 25% tax credit for RD&I, making it financially advantageous for medtech companies to invest in innovation.[9] In 2019, the Irish Medtech Skillnet's report "Realise Your RD&I Ambition" showed almost three quarters of medtech companies were aiming to increase their RD&I efforts in Ireland.[10]

04

Strategic Location

As an EU member state, Ireland serves as a strategic, English-language entry point for non-EU companies, allowing them to tap into a European medical technology market of €160 billion.

"Ireland has one of the best mixed skills workforces worldwide, owing to their ability to work across multiple sectors."

Senior Medtech Executive

Ireland's Medtech Ecosystem

Ireland's medtech ecosystem is key in developing and capitalising on its USPs, and provides the workforce, specialist expertise, and other supports (including workforce development) needed by both local SMEs and large multinationals, as illustrated below.

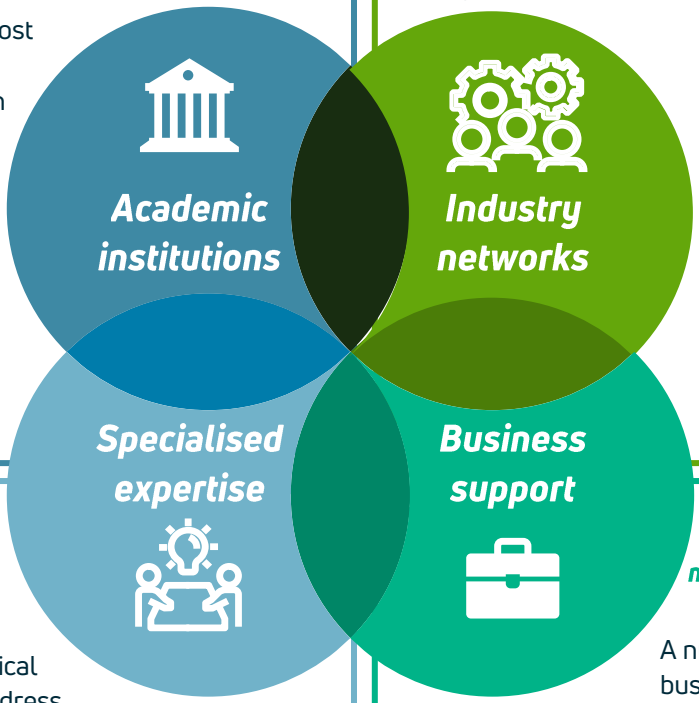
Academic institutions

Ireland has a rich network of universities, institutes of technology and institutes of further education and training providing third-level skills training, with over 16,000 individuals graduating from a Higher Education Authority (HEA) science, maths, engineering, manufacturing or related subject course in 2022.[11] In addition, SOLAS distributes funding for 16 education and training boards for apprenticeships.

These institutes also host some of Ireland's top research centres, often funded by Science Foundation Ireland.

Industry-focused networks

Ireland's most valuable resource is its people, and the country boasts a robust network of talent and training initiatives designed to maximise this asset. Organisations such as Skillnet Ireland, through sector-specific networks like the Irish Medtech Skillnet, develop and deliver industry-led training solutions to address training needs. National programmes like Springboard+ and the Human Capital Initiative actively target key skill needs, ensuring the workforce remains competitive and well-equipped to meet evolving industry demands.



Centres of research excellence

Ireland's centres of excellence offer the critical expertise required to address the most significant challenges in the medtech sector. By partnering with these centres, medtech companies can advance to the next stage of their development and transition to advanced, digitised, and sustainable operational models. Notable centres driving this transformation include:

Manufacturing:

Device development:

Data Analytics and AI:

Business support for multinationals, start-ups, and SMEs

A number of government and business networks provide support to the Irish medtech sector. Key players include:

With over 250 members across the medtech sector, Irish Medtech plays a key role in representing employers' needs and coordinating resources to enhance supports and skills training.

IDA Ireland is a non-commercial, semi-state body which promotes foreign direct investment into Ireland.

Enterprise Ireland is the Irish government's enterprise development agency, which invests in and supports Irish-owned companies on their journey to achieving scale and to become global leaders in their field.[12]

Ireland's Medtech Voice

This report was developed in response to the sector prioritising their skills and training response in the face of the evolving nature of the medtech industry today. Over 200 statements extracted from stakeholder interviews reinforced international trends impacting the skills agenda and the pressing need for support to address emerging skill gaps in Ireland.

Topic	Stakeholder Views
01 Opportunities	All respondents highlighted the sector's further growth potential, its collaborative ethos, diverse pool of specialised and multifaceted skill sets, and its receptiveness to innovative upskilling approaches.
02 Challenges	Industry respondents noted technical skill gaps in digital proficiency and automation, along with key transversal skill gaps in project management and leadership. As a predominantly manufacturing sector, respondents highlighted the challenges of providing training to an operation-critical employee base.
03 Solutions	With evolving skill needs and skills gaps emerging as a result, greater collaboration at the industry/academic interface is needed, alongside additional awareness building of existing training opportunities.
04 RD&I skills needs	SMEs would benefit from additional support in commercialisation strategies. An innovation mindset, enhanced business acumen and strong transversal skills were identified as essential attributes for research graduates. Sustainability and eco-design principles also present new skills challenges for RD&I professionals.
05 Manufacturing skills needs	Digitalisation, automation, and artificial intelligence skills were prioritised by manufacturing professionals, who cautioned that Ireland has a way to go to realise it's ultimate ambition of becoming a global advanced manufacturing exemplar.
06 Regulatory Affairs skills needs	With challenges from the EU's Medical Device Regulation on-going, regulatory affairs professionals are now having to adapt to ever more regulatory requirements relating to sustainability reporting, EHDS, data and AI. Upskilling in new and emerging RA is essential.
07 Sustainability skills needs	All functions noted the accelerating need for sustainability skills; with key challenges and opportunities growing out of emerging professions and new career pathways. Training responses must support medtech organisations to realise their sustainability goals.
08 HR skills needs	HR professionals expressed the urgent need for the development of digitalisation skills, particularly in analysing and leveraging digital platforms. Many HR professionals also identified the need to develop detailed career pathways to empower workforce skills planning & training interventions.

Skills Gaps and Urgent Skill Requirements

Hiring managers across all functions in the Irish medtech sector face their most significant challenges in acquiring technical and specialist skill sets. The need is greatest for expertise in digitalisation, data analytics, and automation.

Skills gaps in medtech

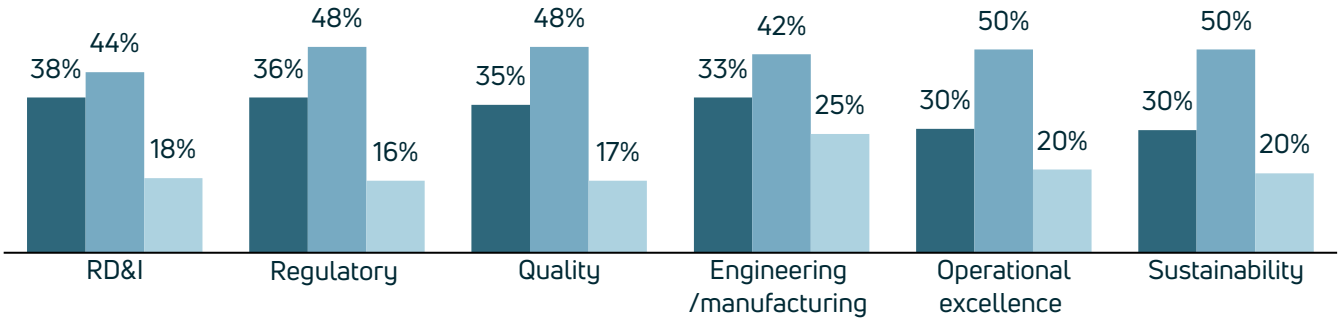
The Irish medtech ecosystem identified technical, digital and transversal skill sets as their greatest needs.

- **"Technical"** relates to non-digital skill sets which apply to certain scenarios and problems (e.g. injection moulding)
- **"Digital"** relates to the shift towards advanced manufacturing (e.g. automation, data analytics)
- **"Transversal"** relates to learned and proven abilities that are transferable across different scenarios, industries and job roles and are essential for personal and professional success (e.g. communication, leadership).

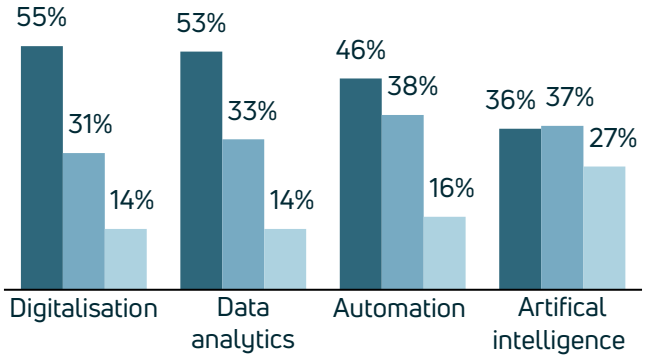
Underneath these broad skill groups, there exist several skill types relating to each function within medtech. We asked over 400 survey respondents which of these functionally related skill types their organisation most urgently required skills training in. All skill needs areas examined report mostly highly urgent (action needed within one year) or moderately urgent (action needed within next four years) skill needs. Only a minimal number of respondents stated functions were at low urgency (five years or longer to act).

High urgency (action needed within one year)
Medium urgency (action needed within two to four years)
Low urgency (action needed in five years or more)

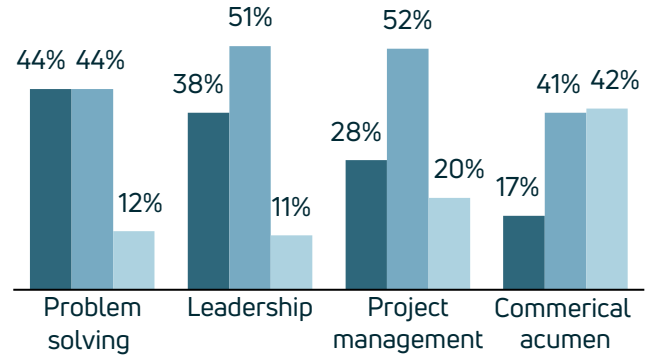
Which (technical) skills are experiencing the most urgent demands for upskilling?
% of respondents stating level of urgency for each skill[a, b]



Which (digital) skills are experiencing the most urgent demands for upskilling?
% of respondents stating level of urgency for each skill[a]



Which (transversal) skills are experiencing the most urgent demands for upskilling?
% of respondents stating level of urgency for each skill[a]



Notes: **[a]** n=402 respondent, **[b]** Totals may not sum to 100 due to rounding of figures to whole digits.
Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

Training and Delivery Methods

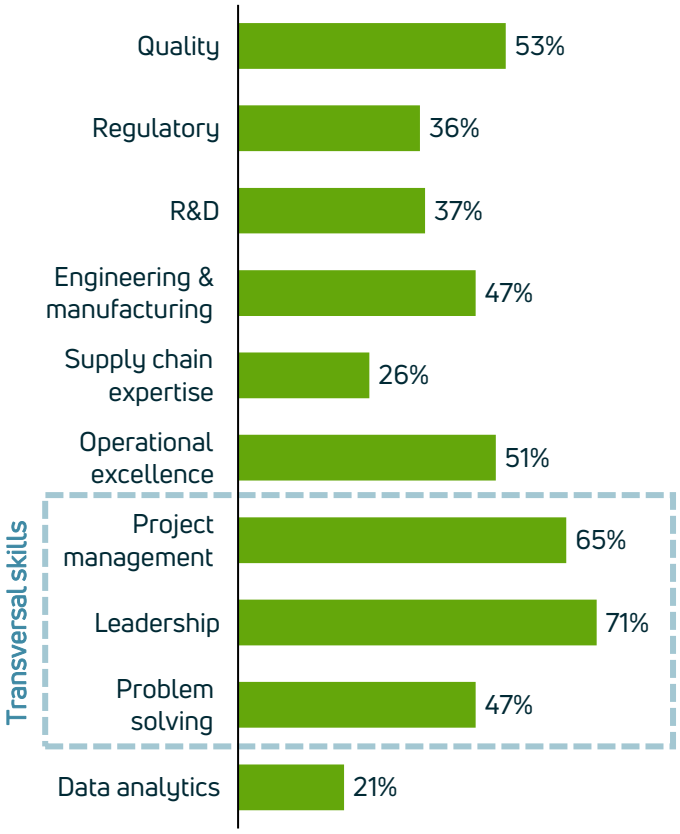
Medtech in-house training offerings in Ireland are most likely to cover transversal skills, with further emphasis required on technical skills. Adapting training delivery methods will be required to reflect employee preferences for blended online and in-person learning.

Details on company provided training

Skills training in Ireland is provided both externally, by entities such as the Irish Medtech Skillnet and internally, by companies themselves. As part of our survey, we asked respondents what areas their company already offers training in, in order to understand how external training should fit into company plans.

Training programmes offered by companies in Ireland emphasise transversal skills, quality management, engineering, and operational excellence. This closely aligns with the industry's historic strengths.

Top 10 training types most likely to be offered by companies in Ireland
% of respondents stating their company offered this training type[a]



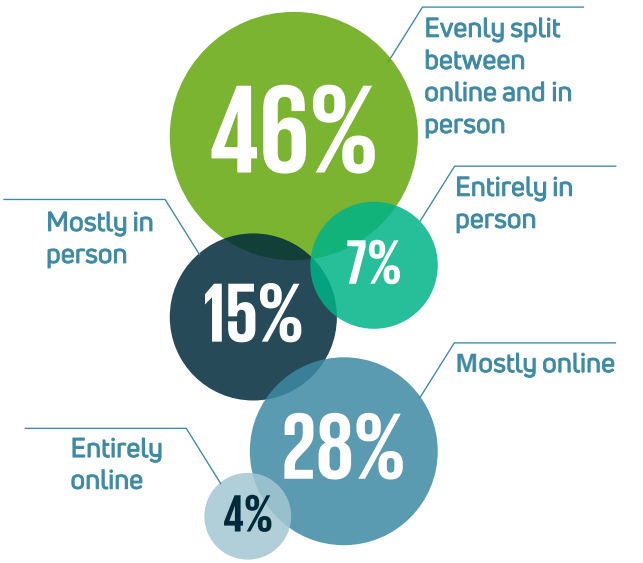
Training course "must-haves"

Skills training can be delivered in a diverse and varied manners. To understand the preferences of the Irish medtech workforce, we asked respondents to tell us the most vital elements of training programmes. The majority of respondents emphasised the need for training courses to incorporate practical elements, with 56% of respondents choosing this. Respondents also wanted flexibility in terms of location or online options (53%). The workforce also highlighted their preference for training courses designed with industry input wherever possible (50%). We note that the Skillnet model of developing training delivered and led by industry closely adheres to the workforce's preferences.

Preferences in training delivery method

The majority of respondents advocated for a hybrid approach, suggesting a 50/50 split between online learning and in-person training as the optimal delivery method for upskilling and training programmes. Avoiding an exclusive reliance on either was viewed as optimal.

What is your preferred upskilling delivery methodology?
% respondents choosing each factor[b]



Notes: [a] n=407 respondents, [b] n= 402 respondents.
Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

Irish Medtech Sector Headcount 2028

By 2028, we project a 3.2% increase in headcount per annum within the Irish medtech sector ecosystem, reaching approximately 56,000 employees. This growth underscores the necessity for substantial investment in training supports.

Forecasting medtech skills needs

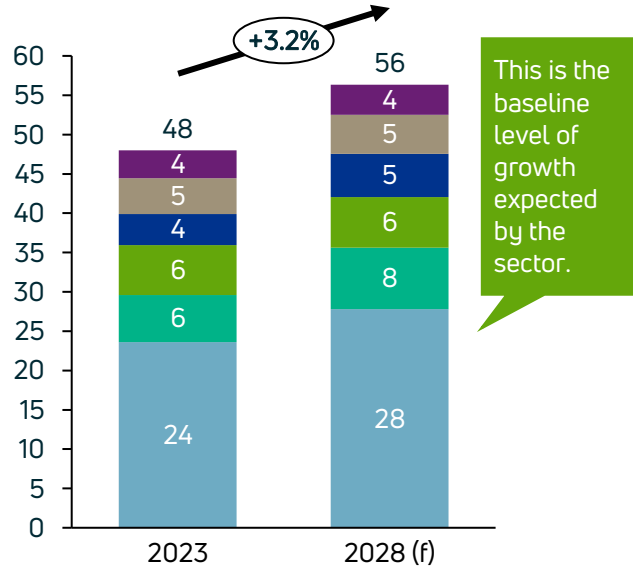
Awareness of future skills requirements should play a role in all strategic planning sessions within medtech companies across the sector, serving as a compass for organisations to navigate future talent requirements. As the industry develops, anticipating skills needs will enable proactive adaptation to emerging trends and technological advancements.

Forecasting headcount growth in the Irish medtech sector ecosystem required extensive research and engagement with stakeholders. A forecast was produced across the five main pillars of this report. This will not only aid in workforce upskilling planning but will also provide guidance as to what employment numbers the medtech industry can achieve in the future under baseline and optimistic scenarios.

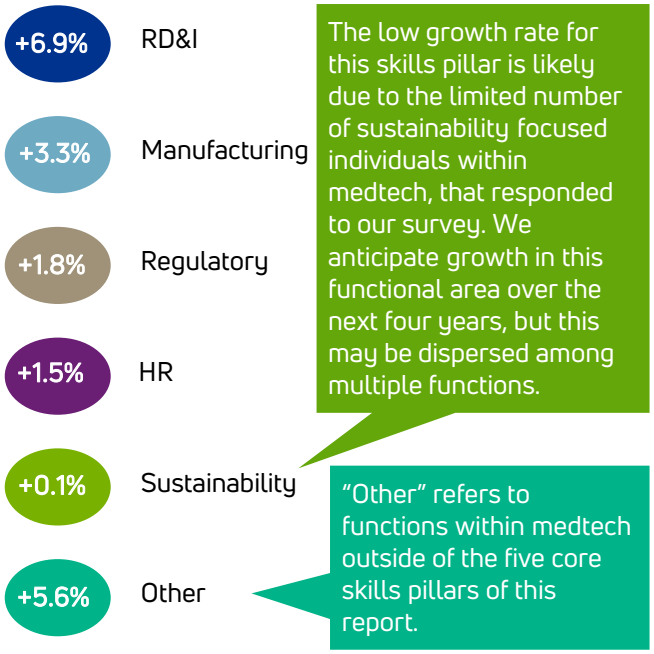
The forecasting approach included:

1. **Sector information:** Utilising the local survey dataset, which captured ~1% of the medtech workforce in Ireland, we gathered information on the current number of employees working across each skills pillar in the sector, namely RD&I, Manufacturing, HR, Regulatory Affairs and Sustainability.
2. **Baseline growth:** The local survey dataset also provided a baseline level of expected growth for each functional area within medtech, gathered by asking about likely hiring activity in the future (shown to the right).
3. **Determination of optimistic/pessimistic growth scenarios:** By leveraging the full breadth of research collected across all workstreams, metrics were applied such as changes in population demographics and the level of health in the population to define an optimistic (upper) and pessimistic (lower) estimate for growth in medtech headcount through to 2028.

Medtech headcount growth by skills pillar
'000s individuals, survey of >400 individuals in medtech, 2023-2028 (f)[a]



Individual function headcount growth
CAGR[b], 2023-2028 (f)



Notes: **[a]** Survey of >400 individuals employed in Irish medtech. Growth rate predictions from companies with less than 50 employees were discounted due to these companies having a different growth trajectory than the industry in general, **[b]** CAGR: Compound Annual Growth Rate. **(f)** Forecasted growth.

Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

Peer Sector Benchmarking

Our analysis of skills and experience levels across peer sectors indicates close alignment between medtech, biopharma, foodtech and technology at more senior levels, where transversal skills rather than specific technical skills are key elements of role profiles.

Approach and key learnings

Our analysis of peer sectors focused on comparing Ireland's medtech sector against biopharma, foodtech and technology across a core set of metrics which examined each sector's status in the Irish economy, its skills needs and current training capacity. Where relevant, skills requirements, best practices and innovative upskilling solutions were captured.

Biopharma

The biopharma sector is another Irish success story, with 19 of the top 20 companies present in Ireland.[13]

Our analysis of the sector revealed that the greatest overlap with medtech regarding skills was in Regulatory Affairs, with overlapping skills in technical writing, submission support, and multi-site collaboration across multiple seniorities. This suggests strong competition for talent in these areas. Sustainability had high overlap as well, with skills including supply chain management, EHS auditing, and KPI oversight.

At Director level we noted common skills for both sectors in the HR and RD&I functions.

Entry level manufacturing role requirements were aligned around process validation and adherence to standard operating procedures, suggesting similar skills are needed to enter the manufacturing functions, with divergence thereafter.

Foodtech

The foodtech sector overlaps significantly with medtech, as another manufacturing sector moving towards a high-tech, sustainable operating model.

Our comparison of skills and experience requirements across both sectors indicated that senior level HR skill sets closely aligned with those in medtech, requiring organisational design, project management, and work process redesign skills. This suggests transferability across sectors. Sustainability in foodtech is also closely aligned to medtech.

Although we noted alignment in requirements at more senior levels in manufacturing and RD&I in both sectors, medtech roles demand more life science technical skills.

Our analysis did not show significant alignment in regulatory roles, suggesting conversion courses would be needed for individuals to transfer from foodtech to medtech.

Technology

The technology industry, including software development, hardware manufacturing, telecoms, and digital innovation, is another Irish sector with a successful track record of FDI. A significant employer of digital talent, it offers crucial insights for all functions of medtech.

HR skills requirements in technology are closely aligned with those in medtech across levels. At more senior levels, there is alignment across manufacturing and sustainability. In addition to skills such as resource planning and manufacturing testing, senior manufacturing personnel often require leadership, critical thinking and other transversal skills, highlighting the value of providing training for these skills needs.

RD&I skills and experience levels were not highly aligned across medtech and tech, which is likely due to the different final product requirements and regulations in place in medtech

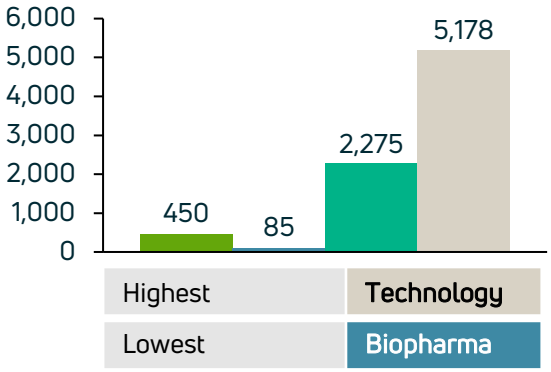
Notes: Further detailed information of the skills and years of experience required across sectors is available from the Irish Medtech Skillnet.

Peer Sector Benchmarking

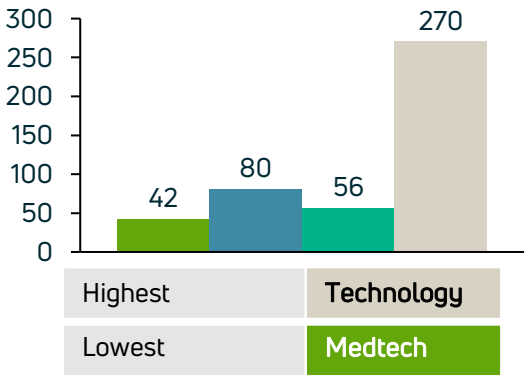
The medtech sector has a greater RD&I output than any comparable sector in Ireland. However, its average number of employees per company is ~95, much lower than biopharma's ~940, in keeping with medtech's greater proportion of SMEs.

Legend: Medtech Biopharma Foodtech Technology

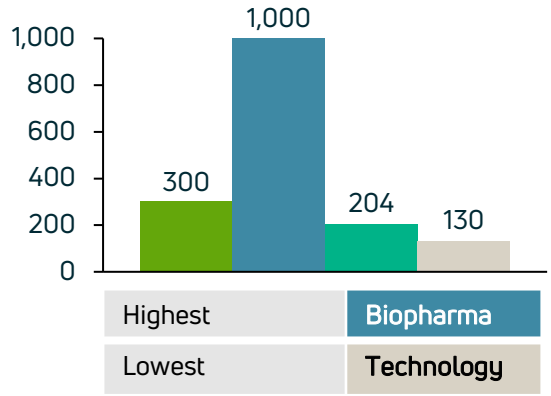
No. of companies per sector
 # companies, 2019 (tech), 2022 (others) [14-17]



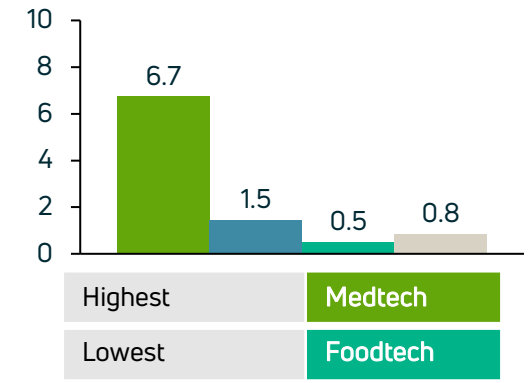
No. of employees per sector
'000s employed, 2022 [14-18]



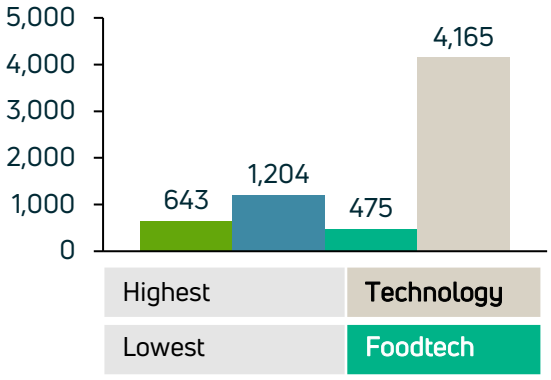
Export value per employee per sector
€'000s / employee, 2022 [14, 15 19, 20]



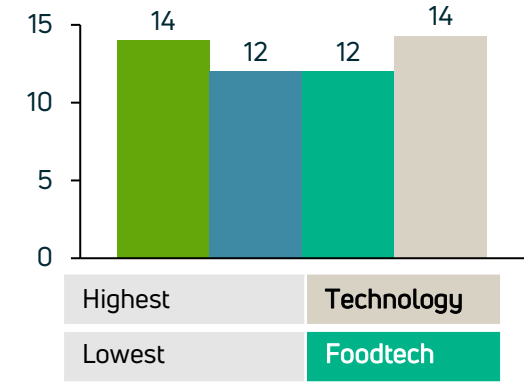
Research activity per employee per sector
 # patents filed with EPO [a] per 1,000 employees in 2022 [21]



Open roles per sector
 # advertised job roles on LinkedIn in Sep 2023 [22]



Employee turnover annually per sector
% employees leaving their workplace per sector, 2022 [23]

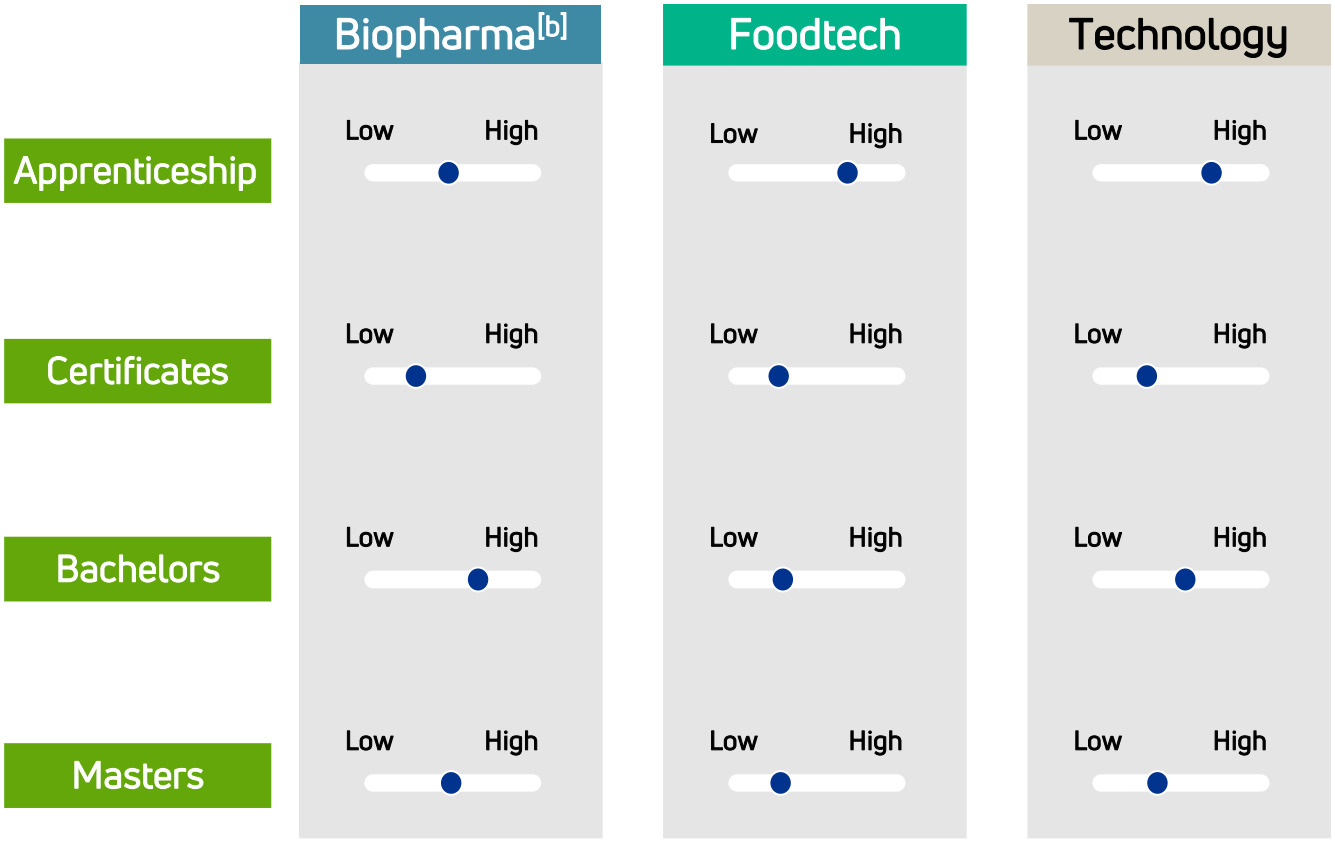


Notes: [a] EPO: European Patent Office

Cross Sector Training Comparison

Analysis of course offerings across sectors shows relatively high alignment between medtech and technology apprenticeships, while medtech's heavy RD&I focus results in many Master's courses being relatively specialist.

Course alignment w/ medtech [a]:



Apprenticeships

Manufacturing engineering apprenticeships are relevant to medtech, biopharma, and foodtech, due to the common skills required to work on a manufacturing line. Technology apprenticeships often revolve around the practical aspects of information technology (IT) and computer science; installing and maintaining hardware, fault-finding, and performance optimisation. These skills, and the mentality they require, are likely to translate favourably to a medtech environment.

Certificates

Certificates and other short courses showed lower alignment with medtech, typically aimed at a specific skills gap.

Bachelors

Bachelor's courses have similarities to biopharma and tech, with less of an undergraduate manufacturing focus. Biomedical engineering courses, incorporating both biology (e.g. cell culture) and data analytics have also emerged in medtech. Foodtech Bachelors often include aspects relating to sensory data processing; a potential peer for medtech as it moves to fully implementing advanced manufacturing processes.

Masters

Medtech courses occupy a more RD&I driven space than biopharma, which leans more toward manufacturing and process development improvements. Systems design is also key in medtech, with data usually only appearing in the context of imaging processing, in contrast to technology where data remains the focus of most Masters. Specialist foodtech Masters (sustainability, regulation, dairy) are common, and there exist engineering Masters aimed at upskilling general engineers to enter the foodtech. sector.

Notes: **[a]** High alignment with medtech is an objective view on courses per sector which are similar in terms of content and structure to medtech, **[b]** Courses have been taken from multiple Irish third-level education hubs, with a total of 25 courses analysed per sector per skills pillar of this report. Some biopharma apprenticeships around laboratory work are less relevant to medtech.

Key Learnings from Ireland

Our sector, skills, and course comparison exercise have uncovered key insights and potential actions for the medtech sector focused on taking learnings from peer sectors and enabling mid-level personnel to reach their full potential

Analysis	What we learned	Relevance for training
Survey	• Urgency is high across all skills groups, with a particular emphasis on digital skills. • The Irish workforce's preference is for flexible, hybrid, industry-developed training. This reflects a significant shift in how employees want to develop their skills and advance their careers.	✓ Urgent digital skills needs span advanced manufacturing, predetermine change control plans and HR Information Systems. Therefore, diverse digital skills training programmes should be deployed according to our recommendations for each pillar. ✓ Skills programmes should closely follow workforce preferences. Focusing on continuous development and career advancement for the learner is likely to meet with workforce acceptance.
Sector comparison	• Medtech's skill requirements are applicable across all three sectors, with a higher degree of alignment observed in senior roles. • Medtech's regulatory affairs skills pillar is most closely aligned with biopharma's, as expected. • Technology HR skills on the other hand are closely aligned with medtech HR requirements.	✓ Skills training could anchor regulatory courses around technical writing and submissions, as these are key skills required to enter the industry. ✓ A short "Introduction to medtech" course could enable manufacturing professionals to transfer from technology/foodtech to medtech given similarities in skill sets.
Sector comparison: skills required and course offerings	• Similar transversal skills are needed across all industries. • Commercial and financial acumen are essential to progress to senior roles across sectors. • Software development and programming increasingly appears on medtech RD&I job listings, as well as technology listings. • Sustainability knowledge and skills are seen in every sector, with no clear leading sector. Stand-alone sustainability roles are rare. • Medtech and technology apprenticeships show high alignment through both theoretical approaches (problem solving, testing, etc.) and practical activities (installing, optimising system outputs, etc.).	✓ There is a clear opportunity to promote cross-sector transversal skill training with adjacent industries. ✓ "Finance for your function" courses should be targeted at individuals aspiring to senior level positions. ✓ Sustainability training will be required for multiple functions. Although there is opportunity for cross-sector learnings, all peer industries face this as a relatively new challenge. ✓ Adopting elements of technology apprenticeships could lead to the creation of an "ICT for medtech" apprenticeship programme.

05

Medtech in key international medtech hubs

International Medtech Hubs

From an initial review of 20 international medtech hubs, and due to comparable aspects to the Irish medtech hub, Minnesota, Singapore, Germany, the UK and Costa Rica were selected for deeper analysis to capture insights on medtech skills needs in the international context.

Key international medtech hubs

Legend: ✓ Similar to Ireland ✗ Different to Ireland

	Minnesota	Singapore	Germany	UK	Costa Rica
Key rationale for inclusion	Long-established medtech hub	Global leader in advanced manufacturing	Major EU hub with high RD&I and technical education	EU-adjacent country with similar education profile to IRE	Medium cost hub building capacity
Additional criteria					
Company #	✓	✗	✗	✗	✓
Employee #	✓	✓	✗	✗	✗
High wage economy	✓	✓	✓	✓	✗
Population	✓	✓	✗	✗	✓
SME ratio	✓	✓	✗	✓	✓
Global players	✓	✓	✓	✓	✓
Long-established hub	✓	✗	✓	✓	✗
Strong RD&I focus	✓	✓	✓	✗	✗
MDR challenges	✗	✓	✓	✓	✗

Hub benchmarking approach

Our international hub benchmarking approach compared the relative size and focus of each international hub's medtech industry, its key skills needs, and the efforts that hub is making to solve them.

The process incorporated three steps, displayed to the right:

1. **Sector Overview per hub, encompassing:**
   - # of companies
   - # of employees
   - Export value
   - # of patents
   - Vacancies
   - SME prevalence
2. **Skills required per hub, encompassing:**
   Analysis of five job roles per skills pillar to find both common and unique skills across different hubs.
3. **Course offerings per hub**
   Analysis of education offerings across five institutions per sector to determine the level of alignment across hubs.

International Hub Activity

Ireland's medtech sector is a leader on the global stage, but competing hubs have key learnings which the Irish sector can leverage, such as Singapore's approach to flexible programmes, and Germany's incorporation of transversal skills training into technical programmes.

Minnesota - Regulatory

Minnesota's medtech ecosystem is supported by a range of course offerings from micro-credentials to in-house training. Minnesota's regulatory affairs courses and offerings are comparable to Ireland's, with EU and US submissions featuring prominently in both, along with less emphasis on reimbursement and post-market surveillance.[24-26]

Director and manager level positions in Ireland and Minnesota have highly aligned years of experience and technical skills requirements for regulatory affairs positions.[a, b]

Singapore - Manufacturing

Singapore's upskilling and training opportunities in medtech range from 3-hr biomedical quality and regulatory systems to a BioDesign Program offered by the government research agency A*STAR on how to foster innovation.[27,28] Ireland is comparable to Singapore's medtech manufacturing industry in director positions. Our survey revealed Singapore is likely to be more technologically advanced than Ireland, as it appears to have already implemented much of its automation requirements.

Germany – RD&I

Germany is a key manufacturing hub, Europe's leading medtech exporter, and Ireland's closest European competitor regarding RD&I output. RD&I in the region has been fostered by upskilling and training opportunities often offered online or via university training courses. Courses often incorporate elements adjacent to the RD&I process, such as teamwork, reimbursement, and business skills.[29,30]

"Ireland has to develop technical skill sets to catch up to those regions which are more advanced, like Singapore."

Senior Medtech Executive

[cont.]

Germany's senior level positions in RD&I from director to manager have high alignment with Ireland, with skills and years of experience required similar between the two regions. Germany's upskilling approach of integrating transversal skills into RD&I programmes could be a learning point for Ireland.

United Kingdom - Sustainability

The UK has a robust offering of short courses for the medtech sector, typically delivered via universities. Medtech courses range from 22-hour biomedical visualisation training to biomedical engineering Postgraduate Certs for more in-depth knowledge.[31,32]

The demand on UK companies to be more Environmental, Social and Governance (ESG) friendly is comparable to Ireland. Manager and mid-level roles had the highest alignment between the two regions. Multiple experts signposted Cambridge University's training as the "gold standard" for sustainability professionals.

Costa Rica - HR

Having grown from a low base over the last two decades, Costa Rica has scaled its medtech industry to over 30,000, with its development agency producing over 40 training initiatives. Multinationals also praised the flexibility and responsiveness of HR and the workforce in general during the COVID-19 pandemic, who quickly adapted to new ways of working without losing productivity. Skills for Director HR roles in Ireland and Costa Rica are highly aligned. Costa Rica's medtech industry has also collaborated with US universities to begin the move towards more advanced processes and RD&I.[33]

"Engineering, microelectronics and software development. Those are the skills gaps in medtech in Singapore."

Medtech RD&I Expert, Singapore

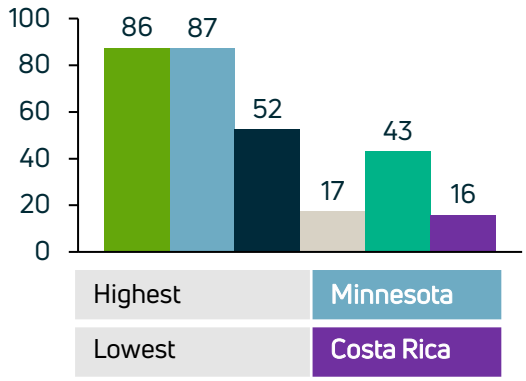
Notes: **[a]** Employment roles have been taken from online job portals (e.g. LinkedIn and company profiles) between September to December 2023, **[b]** High alignment with medtech is an objective view on roles across International medtech hubs which have similar requirements to medtech roles in Ireland.

International Hub Benchmarking

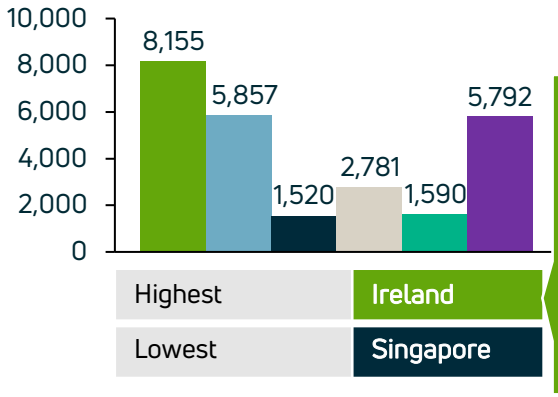
Ireland's medtech sector leads in per capita size, exports, and RD&I among EU hubs. However, high vacancies persist, and there is scope to align SME percentage and patent numbers with benchmarks set by hubs like the US and Singapore.

Legend: Ireland · Minnesota · Singapore · Germany · UK · Costa Rica

No. of companies per million population
 # medtech companies / million population [a]

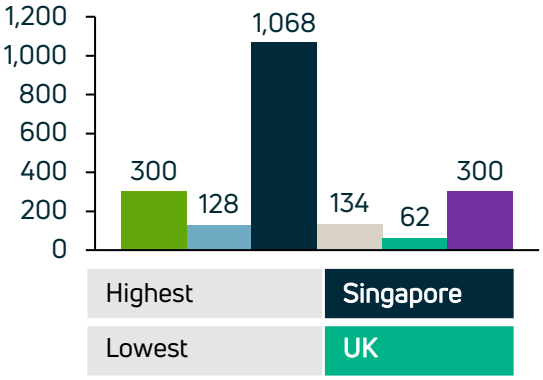


No. of employees per million population
000s employed / million population [a]

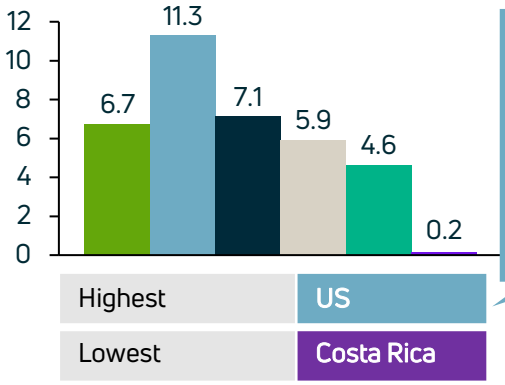


Since 2022, the Irish medtech sector's headcount has increased further to 48,000.

Export value per employee
€'000s / employee, 2022 [a, b]

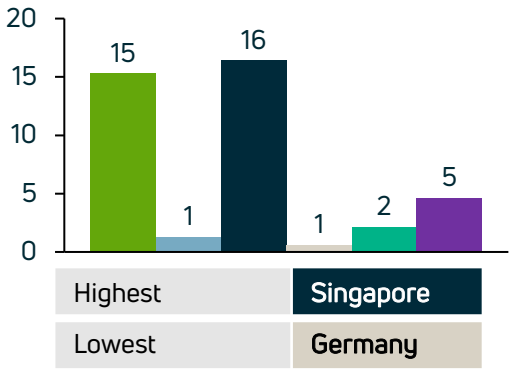


Research activity per employee
 # patents filed with EPO per 1,000 employees in 2022

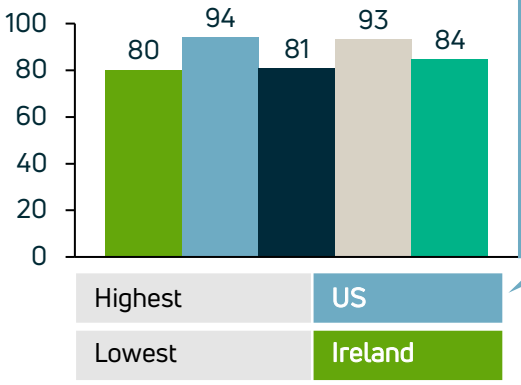


Refers to US data overall due to lack of Minnesota-specific data.

Vacancies per 1000 employees
 # advertised job roles on LinkedIn in Sep 2023



SME prevalence
% companies which are SMEs, 2022 [a, c]



Refers to US data overall due to lack of Minnesota-specific data.

Notes: **[a]** All statistics are for 2022 or the most recent available. **[b]** US trade sources state ~70% of Singaporean imports are re-exported. This indicates the value per employee is closer to ~€664, if these are excluded. **[c]** Exact figures are not available for Costa Rican SME % but may be below Ireland.

References: [24-38]

Learnings from Key International Hubs

The activities of international medtech hubs indicate many potential actions for Irish Medtech Skillnet, including interacting with school leavers and ensuring courses are marketed correctly to ensure maximum uptake among desired functions.

Hub	What we learned	Relevance for upskilling
Minnesota	• Minnesota offers a number of multi-week, short courses in partnership with multinationals, aimed at giving individuals the basic knowledge necessary for entry-level manufacturing roles.	Medtech training could encompass courses for entry level personnel; Minnesota shows that even short courses have value, potentially as a stepping stone to an apprenticeship.
Singapore	• Singapore typically adapts training by making specific references to distinct levels of seniority (e.g., managers with an annual budget of <€500k) or functions. The A*STAR BioDesign program is a notable illustration of this approach, where the same program is conducted on separate days for different functions.	Marketing courses specifically to various functions, without major content revision, would be an obvious first-step for the sector. This was also recommended by some of our pillar workshops.
Germany	• Germany's RD&I courses generally incorporate holistic elements such as regulation, designing with the end patient in mind, and transversal skills such as teamwork.	Medtech skills providers could offer such holistic training to RD&I professionals and those currently in academia who may be less attuned to an industry environment.
United Kingdom	• The UK medtech landscape reacted quickly to the National Health Service (NHS) plans to introduce ESG weighting and mandatory Scope 1 / 2 / 3 emissions reporting for suppliers, e.g. the British IVD association offered sustainability training to all members.	The University of Cambridge's Institute for Sustainability Leadership's 8-week, 10hrs/week course was spoken of as a clear model for sustainability training. A similar model could be applied to the Irish medtech sector.
Costa Rica	• Costa Rica readily cooperates with international partner universities (Standford) to develop its upskilling offering. • A strong focus on getting school leavers "industry-ready" has helped create a ready workforce for multinationals in the region.	BioInnovate is an Irish example of a successful partnership with an international university. Ireland could investigate the possibility of further collaboration with international training partners; potentially in sustainability and other key developing areas.

Singapore: International Hub In-Depth Analysis

We conducted a deep dive analysis of two regions, including deploying international surveys to capture perspectives on skills needs. Singapore was selected as a high-tech hub with strengths in advanced manufacturing, robotics, and RD&I.

Peer comparison

Population	5.2m[39]	5.9m[42]
# companies	450[6]	310[8]
# employees	48,000[40]	9,000[43]
% of worldwide medtech exports	4.9%[41]	3.4%[41]

Hub overview

Medtech in Singapore

Singapore's life sciences industry has undergone significant transformation in recent years, starting from a modest foundation in the 1980s to now being a global leader in advanced manufacturing. The pursuit of FDI was strategic, initially attracting pharmaceutical manufacturers. Over time, this expanded to include biopharma RD&I and medtech, with a later focus on clinical trials. The Singaporean medtech ecosystem has a diverse mix of skill sets which support its manufacturing, RD&I and commercial functions. It has particular strengths in lab equipment, producing 60% of the world's microarrays, and one third of its mass spectrometers and thermal cyclers. Singapore also hosts 50 regional headquarters of global medtech firms, underpinning its USP as a business-friendly, strategically located hub.[45]

As a small island nation lacking natural resources, similar to Ireland, Singapore has generally sought to apply its well-educated population and collaborative ethos with the aim to drive its success.

"Singapore conducts a substantial proportion of RD&I in the medtech industry. We have significant access to local talent."

Medtech RD&I Expert, Singapore

An example of this is in the MedTech Manufacturing Alliance, a close collaboration between small companies, multinationals, education providers and the government research institute A*STAR. It operates under a "pyramid" approach, where the "anchor" or "tier 1" stakeholders outline major problems. These are communicated to industry service providers, which can collaborate with research institutions to produce solutions. The current focus areas are smart manufacturing, diagnostics, and laboratory automation.

Singapore's collaborative landscape is also evident in RD&I, where the country ranks 7th in the world. This is in part enabled by close health system-research partnerships, with hospitals hosting university research units.

The country's high level of technological adoption has also resulted in high productivity, with Singapore producing a much larger export output per employee compared to other medtech hubs.

"In terms of what we need for upskilling, we should develop virtual reality training modules that will allow medtech personnel to perform difficult operations."

Medtech RD&I Expert, Minnesota

Minnesota: International Hub In-Depth Analysis

Our second comparator hub was Minnesota, a leading manufacturing region within the US which is of comparable size to Ireland.

Peer comparison

Population	5.2m[39]	5.8m[44]
# companies	450[6]	~600
# employees	48,000[40]	>33,000
% of worldwide medtech exports	4.9%[41]	17.9% (all of US)[41]

Hub overview

Medtech in Minnesota

Minnesota is one of the leading regions in the US for medtech manufacturing, with large multinational firms based in the region including Medtronic, 3M Healthcare and Boston Scientific. The local medtech industry's leading subsectors include electromedical devices and surgical-related products (appliances, instruments, and supplies), which together make up >90% of its revenue.[46]

Medtech organisations and academic institutions in Minnesota have fostered a productive upskilling ecosystem. This has been backed by world renowned medical centres for excellence (e.g. Mayo Clinic, the US's number one ranked hospital) and the University of Minnesota's Earl E. Bakken medical device centre. There are also weeks-long training courses designed for entry level roles, aimed at equipping future employees with the basic skills required to enter the industry.

"There should be a greater push in encouraging more strategic collaborations in the sector, as well as retaining internal talent, and more investment into continuous learning.

Medtech RD&I Expert, Minnesota

In 2023, the US Department of Commerce designated the state as the country's centre for the next-generation medical device technology development, referred to as "Minnesota medtech 3.0". This government initiative aims to move the Minnesotan medtech industry to "MedTech 3.0" - characterised by smart medtech, enabling technologies (e.g. point-of-care diagnostics, robotic-device, and other tools which make medtech easier to use), and greater sharing of data.

The initiative outlines an array of factors which it believes will ensure Minnesota's success in "MedTech 3.0", including transferring skills from historic strengths in healthcare and manufacturing, collaborating with local suppliers in non-medtech markets of relevance (e.g. semiconductor manufacturing, IT), and greater use of apprenticeships and other programmes leading to roles in manufacturing. Other key initiatives include the sharing of non-competitive data and best-practices, which the initiative aims to drive locally.

"Our skills gaps are all technical, mainly associated with all emerging and upcoming technologies in the sector."

Medtech RD&I Expert, Minnesota

International Hub Skills Requirements

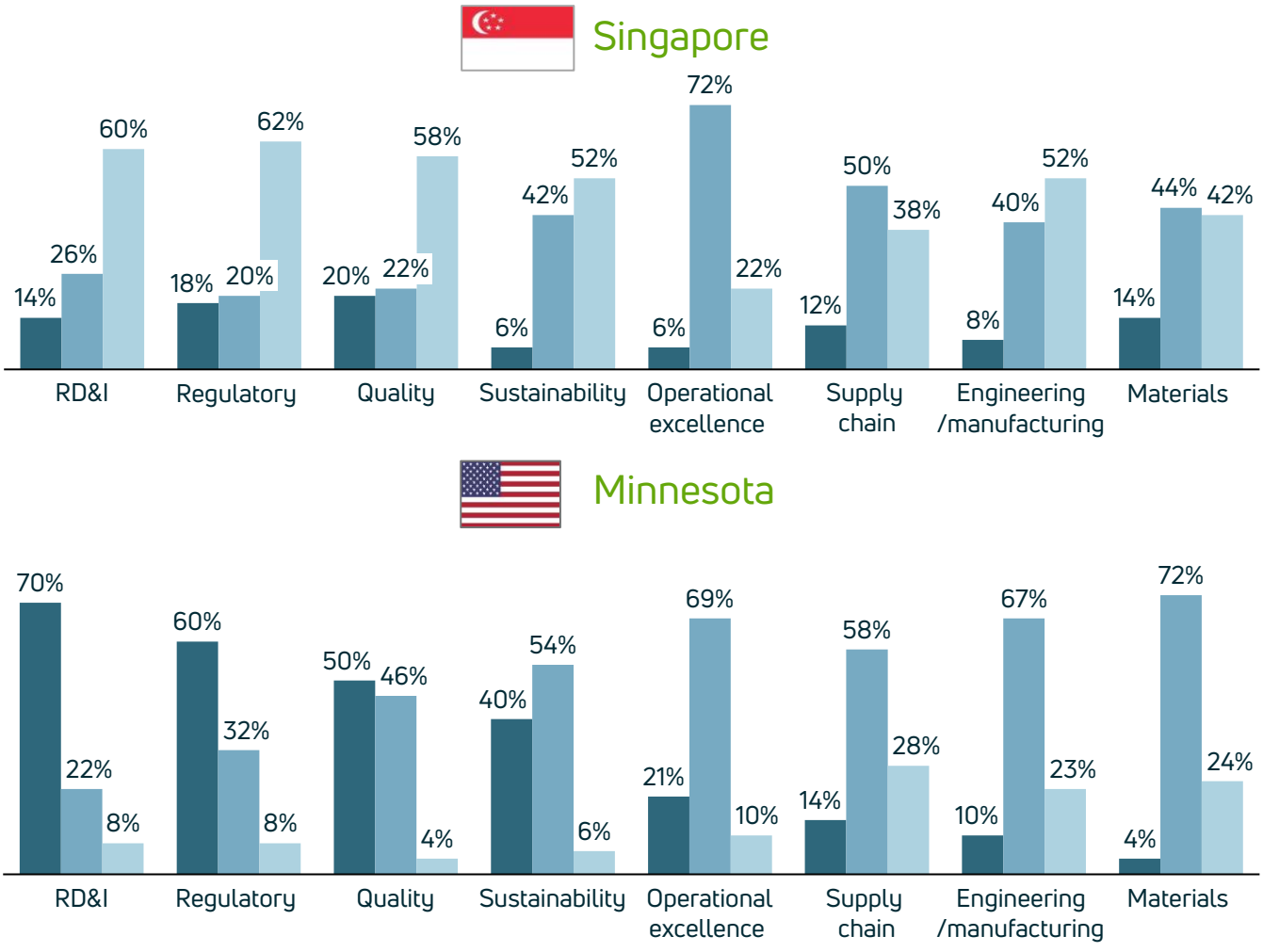
Technical skills needs in Singapore predominantly fall within the medium to low urgency range, whereas Minnesota is experiencing medium to high urgency in RD&I and Regulatory skills needs. In our Irish survey, similar medium to high skills needs were reported.

Technical skills requirements

In contrast to Ireland, which identified medium to high urgency skills needs across technical skills domains, Singapore reveals a lower prevalence of high urgency skills gaps. This discrepancy may be attributed both to Singapore's adeptness in attracting international talent to address its workforce needs and to the deployment of innovative training solutions. Ireland should likewise greatly scale its digitalisation supports and should look to Singapore as a potential model in doing so. Minnesota has a profile similar to Ireland's, with moderate urgency in most areas. It is distinguished from Ireland in having more urgent regulatory, quality, and RD&I needs,. This likely reflects these talent bases being well established in Ireland as a global manufacturing and RD&I hub.

- High urgency (action needed within one year)
- Medium urgency (action needed within two to four years)
- Low urgency (action needed in five years or more)

Which (technical) skills are experiencing the most urgent demands for upskilling?
# of respondents for each skill and level of urgency[a, b]



Notes: **[a]** n=50 respondents based in Singapore and n=50 respondents based in Minnesota, unless otherwise stated, **[b]** Totals may not sum to 100 due to rounding of figures to whole digits

Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

International Hub Skills Requirements

Singapore has less digitalisation skills needs than either Minnesota or Ireland, indicating it may be pulling ahead of other hubs in the advanced manufacturing race. In all three regions, transversal skills like problem solving and leadership are key skill gaps.

Digital skills requirements

Minnesota has intense skills needs across all digitalisation skills, similar to Ireland. Singapore has lower priorities in general, but the medium urgency ascribed to AI-related skill sets suggests medtech in Singapore is beginning to shift towards AI-empowered processes. This likely indicates a higher base level of automation and digitalisation compared to Minnesota or Ireland and indicates this hub may be ahead of Ireland in digitalisation.

Transversal skills requirements

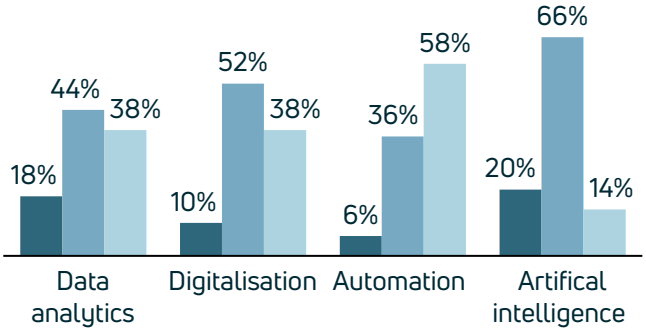
Similar to Ireland, both nations' medtech ecosystems face gaps in transversal skill sets. Problem-solving and leadership emerge as having the highest urgency. The commonality in transversal skills needs between all three countries suggests that recruiting for these skill sets may be universally challenging.

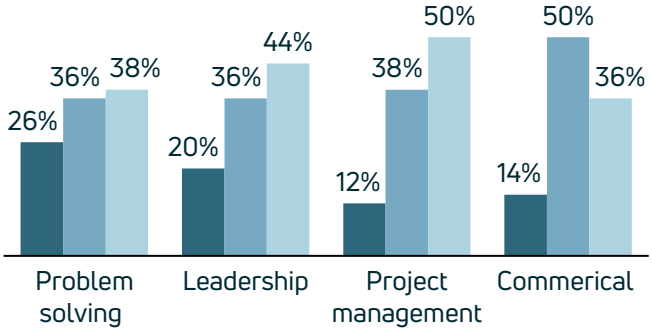
High urgency (action needed within one year)
Medium urgency (action needed within two to four years)
Low urgency (action needed in five years or more)

Which (digital) skills are experiencing the most urgent demands for upskilling?
# of respondents for each skill and urgency[a,b]

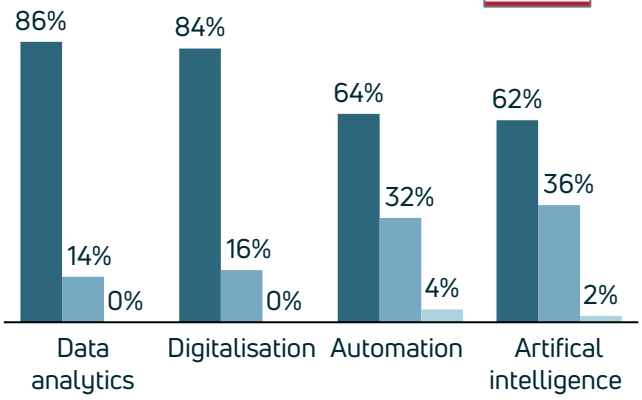
Which (transversal) skills are experiencing the most urgent demands for upskilling?
# of respondents for each skill and urgency[a], b]

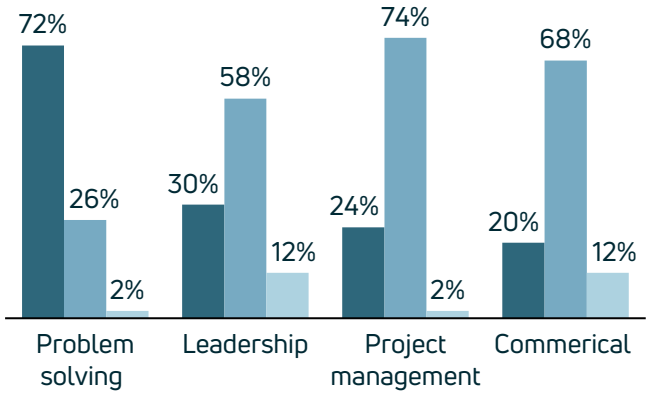
Singapore





Minnesota





Notes: **[a]** n=50 respondents based in Singapore and n=50 respondents based in Minnesota, unless otherwise stated, **[b]** Totals may not sum to 100 due to rounding of figures to whole digits

Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

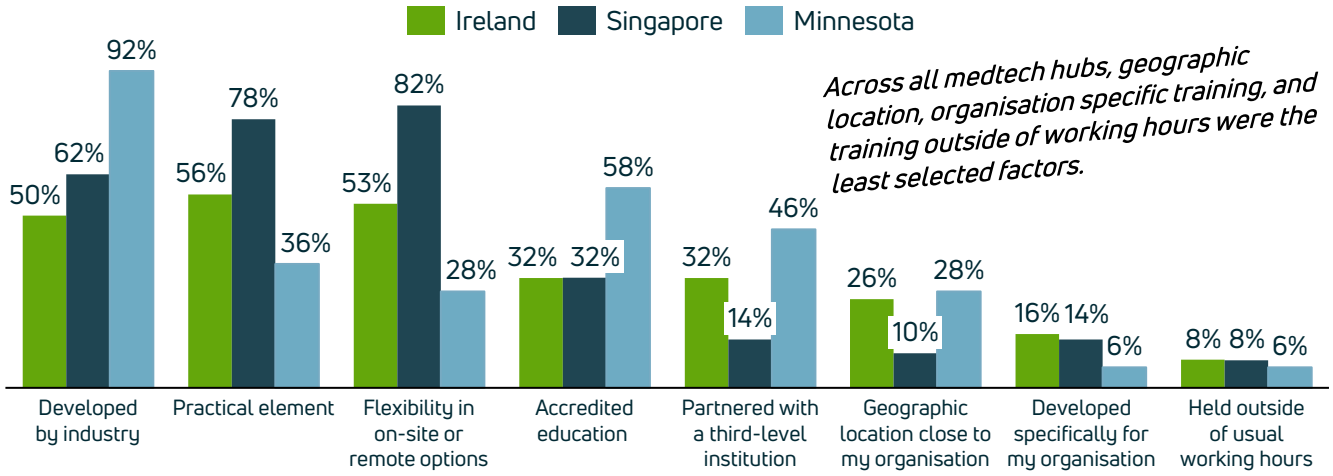
Learning Preferences Benchmarking

Regardless of geography, practical, flexible training developed with industry input is most valued by the medtech workforce. Employees in all regions prefer a hybrid virtual : in-person approach to training.

Relative importance of approaches to upskilling

All medtech respondents highlighted the importance of industry-led elements in upskilling initiatives, with flexibility in on-site or remote attendance and practical elements also frequently chosen. There are also key differences among hubs. The high emphasis placed on practical training by Singaporean respondents may reflect the fact that >90% of respondents completed a work placement throughout their education, meaning they readily understand the value of practical training. Minnesota values accreditation and third-level involvement but places a much lower value on flexibility than other hubs, corresponding with the fact that this hub most prefers in-person learning (see "Training Delivery" below). However, the shared prioritisation of industry-development and practical elements in upskilling across all countries implies that these findings should be regarded as industry norms rather than regional distinctions. These factors should be prioritised in all skills training.

Which factors are most important to you when choosing an upskilling course?
% of respondents choosing each factor[a-d]



Training delivery

Aligned with our Irish dataset, a majority of Singaporeans expressed a preference for a blended approach to training delivery, indicating that a 50/50 split between online learning and in-person training is perceived as the optimal delivery method for upskilling and training programmes. Although Minnesotan favour more in-person learning, all respondent groups highlighted that entirely online and in-person programmes are undesirable.

Across regions, our findings support the assertion that hybrid approaches to training delivery will be best received by the medtech sector.

"Online courses are great but you can only work online for so long.... it's good to have an in-person element where you can learn from each other. Working together is very much part and parcel of medtech."

Medtech HR Expert

Notes: **[a]** n=404 respondents based in Ireland **[b]** n=50 respondents based in Singapore and n=50 respondents based in Minnesota, **[c]** Respondents were prompted to select three factors., **[d]** Totals may not sum to 100 due to rounding of figures to whole digits

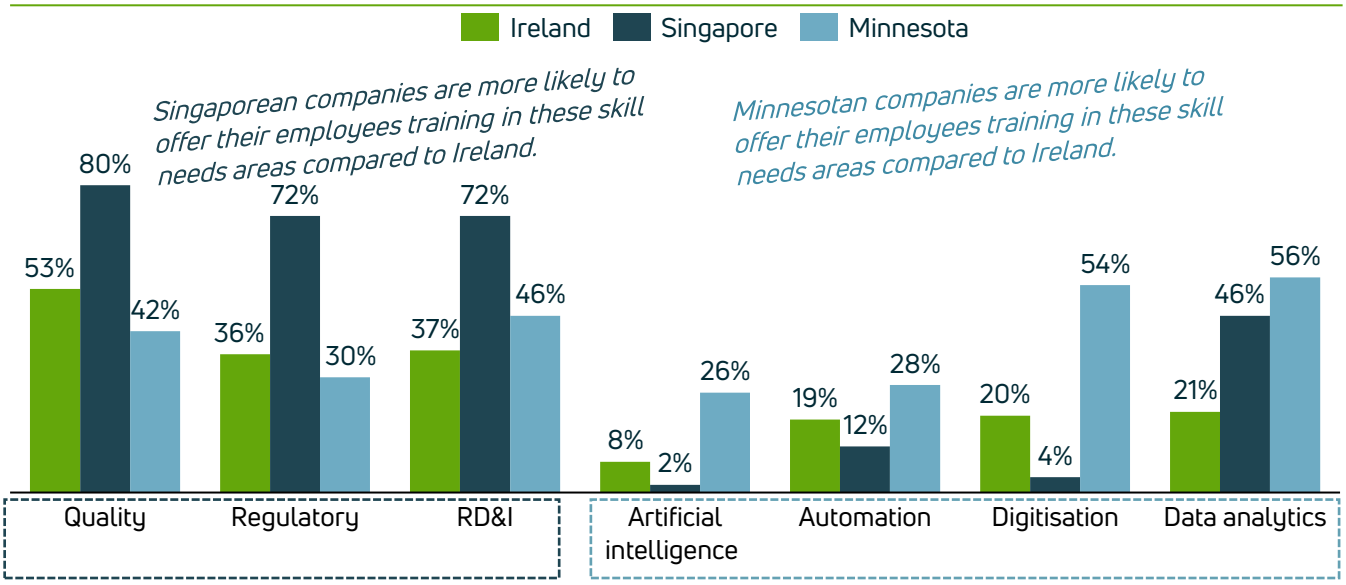
Source: KPMG international surveys, September 2023 (Singapore) and February-March 2024 (Minnesota).

International Skills Provision & Needs

Minnesota and Ireland both report urgent digital skill needs, but Minnesota appears to be responding faster with double the rate of internal skill provision in most digital skills. Singapore provides ample in-house Quality, Regulatory, and RD&I training.

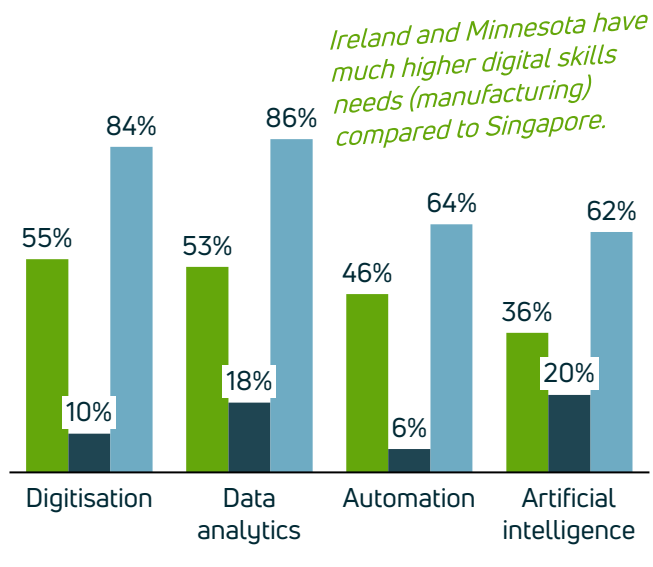
Training programmes offered by companies

% of respondents[a,d,e]



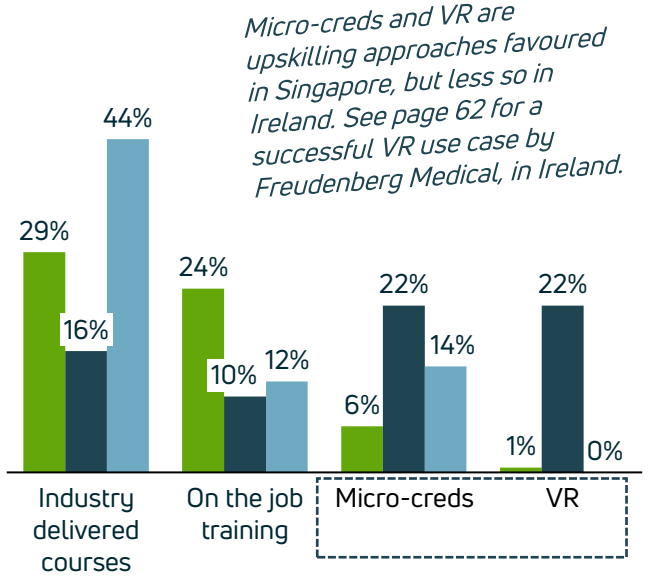
Digital skill needs

% of respondents ranking need as highly urgent[b,d,e]



Approaches to address skill needs

% of respondents ranking approach most suitable[c-e]



Singapore's openness to adopting digital and innovative training methodologies has likely contributed to its success in medtech. This creates a clear learning opportunity for the Irish sector. In Minnesota, companies are more likely to train internally for digital manufacturing skills than in Ireland. Given the shortfall in in-company digital manufacturing and Digitalisation training, an opportunity exists for Ireland-based companies to leverage the services of external training partners to increase this important skill set.

Notes: **[a]** n=405 respondents based in Ireland, **[b]** n=326 to 339 respondents based in Ireland, **[c]** n=330 respondents based in Ireland, **[d]** n=50 respondents based in Singapore and n=50 respondents based in Minnesota,. Only the most divergent responses have been shown for each question. **[e]** Totals may not sum to 100 due to rounding of figures to whole digits

Source: KPMG international surveys, September 2023 (Singapore) and February-March 2024 (Minnesota).

Lessons for Ireland

Singapore, Minnesota, and Ireland are confronting issues around regulation and the shift to a digital future. The prioritisation of similar actions across hubs and the embracing of novel technology, like VR, provides some guidance for Ireland's skills training future.

01

Clarification of career pathways and skills needs

"Clarifying medtech career pathways" was identified as the most vital action to help grow the skill base for the sector in Singapore, with "Developing a skills needs assessment tool" the 2nd most vital, similar to Minnesota. Both actions rank highly in Ireland (2nd and 4th) indicating that these are valued by the workforce as sector-wide, landscape-benefitting tools.

02

Emphasis on "on-the-job" and work-study programmes

>90% of all Singaporean respondents, drawn from diverse functions including Manufacturing (31% of respondents), RD&I (25%), Medical Affairs (17%), and Quality (13%), participated in an "on-the-job" or work-study program such as the "SkillsFuture Earn and Learn". There is likely scope to drive similar approaches such as apprenticeships in Ireland, across all functions.

03

Universal challenges in transversal skills

The most urgent skill requirements in Singapore are "Problem solving" and "Leadership and People Management", which rank 4th and 5th in Ireland. "Project Management" is Minnesota's most urgent skill need. These are not emerging requirements, indicating there is a perennial challenge in transversal skills. New approaches like personality-based engagement, role play learning, and on-the-job applications may be required to tackle this area, which ranks just behind digital skill needs in Ireland.

04

Potential to adopt new training approaches

Singaporeans are enthusiastic regarding VR and micro-credentials, but Irish respondents gravitate towards courses delivered with industry input and "on-the-job training". Novel approaches like VR may face barriers to adoption in Ireland, but their high prioritisation by a high-tech hub indicates the effort is likely to be worthwhile.

05

Enhanced response to challenges elsewhere

~80% of Singaporean and Minnesotan companies offer internal training in each hub's most urgently needed skill, while only 10% of Irish companies offer internal training in Digitalisation, Ireland's most needed skill. In Ireland, there is a clear need for external training partners to provide additional training interventions, building-on and augmenting existing in-company training in these key skills areas.

06

Future Skills Needs: Transversal and Digital skills

Essential Transversal Skills

Transversal skills were highlighted throughout our research and during focus group sessions as urgent skills needs across Ireland's medtech sector. These skills are relevant cross-functionally and should be an ongoing focus for both current and future training and upskilling programmes.

The importance of transversal skills

Transversal skills, frequently referred to as "soft" skills, are transferrable skills which can be applied in different contexts, places, or settings, and which do not relate to a specific task. These skills are important to all functions and roles across every sector and are becoming more relevant as automation renders the global workforce less focused on repetitive actions. Our research on Ireland's medtech sector revealed that despite the highly technical nature of the industry, there are key emerging gaps in the transversal skills outlined below which should be addressed through training programmes. In contrast, international medtech hubs are prioritising transversal skills training, recognising the importance these skills provide in accelerating growth, providing a key learning for Irish medtech stakeholders.

Problem solving

Problem solving skills, namely the ability to assess and resolve challenges in the workplace were highlighted across our industry surveys and focus groups as a current skills need.

Empowering individuals with problem-solving methodologies to identify solutions was emphasised as a desired training outcome for Irish medtech. The HR function, in particular, highlighted this transversal skill as a top priority to enable their effective operation within the organisation. Similarly, regulatory professionals, who often need to act despite regulatory ambiguity, emphasised this skill as key for their role.

Commercial acumen

Commercial acumen is a skill which relates to the individual's awareness of the underlying commercial aspects of a business, and the key factors which impact business performance. It incorporates an understanding of the market context for a company's products, the competitive landscape, financial understanding, strategy and an ability to interact with others in a business context.

Specific training programmes in commercial acumen were highlighted as being of particular interest to HR professionals, who may traditionally not have significant exposure to the commercial aspects of the organisation.

Stakeholder management

Stakeholder management skills were highlighted as current gaps across regulatory, RD&I and HR functions, although it is a necessary skill for all functional areas.

It is the process of identifying and building working relationships with internal stakeholders within an organisation, such as colleagues, adjacent functions or business units, as well as external stakeholders such as customers, regulators, suppliers or sectors to achieve a strategic business goal.

Strategic thinking

Strategic thinking is a vital skill that enables individuals to adopt a forward-looking perspective, considering the long-term needs of the business and anticipating future risks.

These skills are essential across all functions to adapt to global macro-trends impacting the sector.

This includes the deployment of automation in manufacturing, developing new regulatory strategies for innovative product types, and forming strategic partnerships to address sustainability agendas.

Essential Transversal Skills

Skills needs in project management, leadership and critical thinking, alongside an ability to communicate clearly and confidentially are needed to drive the continued growth of all functions in the medtech sector.

Project management

Project management skills are critical to all functional areas to ensure that projects are completed on time, within scope, within budget and with risks appropriately mitigated. This skill requires elements of several other transversal skills, such as leadership, communication, problem solving and commercial acumen, as well as knowledge of specific project management methodologies.

It also requires a technical understanding of the function, particularly in areas like sustainability, where project managers will need to understand and communicate what value the project will bring from an ESG perspective. In manufacturing, project management skills needs were identified at the new product or process stage, and at the interface between RD&I and manufacturing. HR and regulatory professionals also highlighted a need for this skill, with training tailored to their specific functions e.g. global launch project management for regulatory.

Communication

Communication is a broad transversal skill which spans all functions, and incorporates skills such as negotiation, influencing and relationship building. Communication skills can be both general and function dependent; for example, in sustainability a need was highlighted for individuals with external communication skills to clearly articulate the ESG aspects of a business service or product.

In RD&I, effective communication skills are needed to clearly convey data to colleagues in a meaningful way, and at more senior levels to build investment cases and communicate with investors/shareholders.

Leadership

Leadership skills, both business and technical are key to ensuring the continued growth of the medtech sector. In the RD&I function, there's a recognised gap in business leadership skills. Our focus group expressed a strong desire for training which could develop these skills in RD&I professionals, equipping them to manage projects and multi-disciplinary teams, and drive business case development.

Regulatory professionals also identified leadership as a crucial skill for enabling their function to contribute additional value to the commercial decisions of the organisation in a complex and evolving regulatory landscape,

Critical thinking

Critical thinking, while similar to other noted transversal skills such as problem solving and strategic thinking, is more focused on analysing complex and varied data to make an informed decision.

Regulatory professionals noted a difficulty in upskilling individuals in the area of critical thinking, a view broadly shared by manufacturing. Training programmes which could teach individuals how to ask the right questions and critically assess data were viewed as highly valuable.

> "You need someone who thinks about the future, can manage a complex project, influence across the organisation and can find solutions."
>
> **Medtech RD&I Expert**

Digital Skills

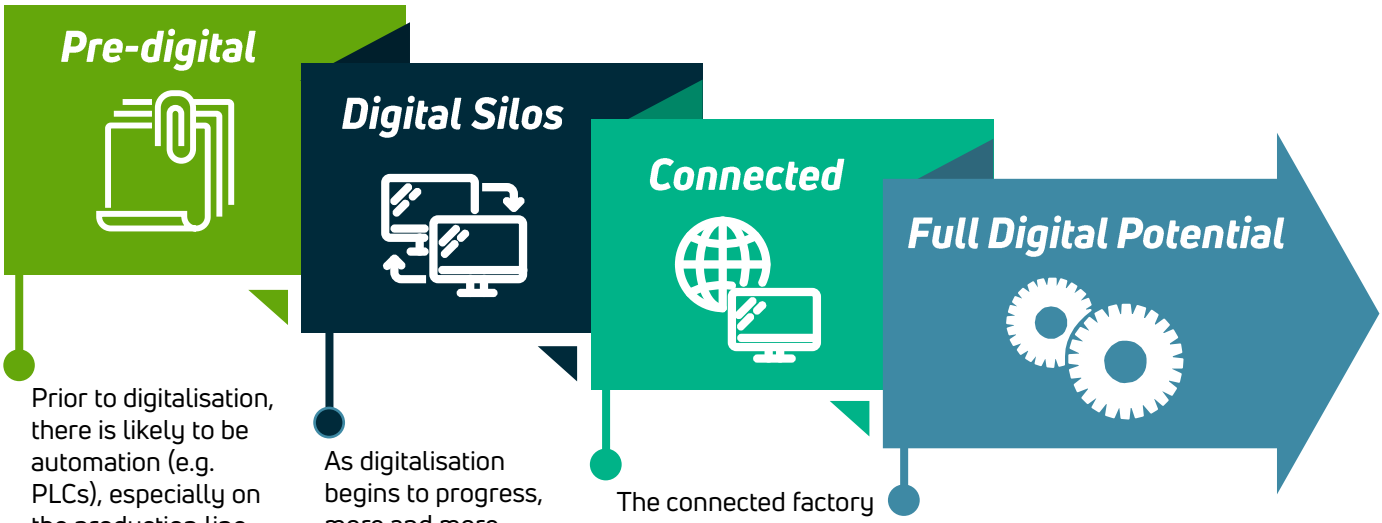
In today's business environment, the survival of organisations depends on technological advancement and online presence which is poised to revolutionise the medtech industry as well as society at large. It will create skill needs for every function and role, both highly technical and more general in nature. Digitalisation will remodel the way we live and how businesses operate.

Digitalisation as a fundamental change in the medtech industry

Digitalisation and the Industrial Internet of Things will revolutionise the medtech industry, including every role from the shop floor to senior leadership. Some individuals will have pivotal roles in designing, implementing, and maintaining digital tools and processes, and will require highly technical skill sets for this challenge. Regardless of function, skills such as human-machine interfacing, basic digital literacy, interpretation of visual data, using digital tools (e.g. large language models), and data-driven decision making will emerge as necessary. Additionally, transversal skills such as change management, leadership, and negotiation will now need to occur in digital contexts, which generate new skills needs in applying these traditional skills.

Skills needs around functions will also emerge. The digitalisation of HR will mean this function will need to retrain in digital communications and use of HR information systems, while RD&I personnel are increasingly applying AI powered tools as part of the development process or are incorporating advanced analytics into the product itself. As an example of how digitalisation will progress, we outline below in high-level the adoption of digitalisation in medtech manufacturing and highlight how this process builds on itself to eventually impact all roles.

The adoption of digitalisation in medtech: a manufacturing example



Prior to digitalisation, there is likely to be automation (e.g. PLCs), especially on the production line, but systems still require manual inputs and adjustments. Reporting and data outputs are paper-based and rely on manual processes. Only operators interacting directly with machines need have digital skills.

As digitalisation begins to progress, more and more systems become automated and some workers across functions are used to interacting with these systems and producing automated outputs. There is no integration of these systems and no real-time flow of information.

The connected factory typically has data flow between shop floor elements (SCADA, PLCs), mid-level systems (MES), and overall enterprise resource planning systems. Although the level of analytics may be limited, employees are analysing and storing data for decision making.

In a fully digitised factory, predictive analytics takes place on real-time data, allowing supervisors to make informed decisions based on end-to-end visibility of operations. All employee roles are impacted by digital systems, even if they do not directly interact with them. AI produces insights to guide decision making, while digital twins in communication with their real-world counterparts model the effects of change and relay these back to the supervisor. Eventually, such communication is directly to the manufacturing systems themselves, making the plant self-adaptive.

This example refers to manufacturing; however, it can be readily seen that Digitalisation will occur in every function. Indeed, information from a digitised manufacturing line could eventually feed into other departments such as Regulatory Affairs and Sustainability, allowing these functions to gather, in real-time, the data they need to fulfil their roles.

07

Future Skills Needs: Research, Development, and Innovation

Key Trends Shaping RD&I

The RD&I function will deliver the next generation of scalable smart medical devices. This will require a broad range of future skills, overlapping with manufacturing, regulatory affairs and sustainability.

The evolving RD&I function

Medtech innovation is occurring at an unpreceded pace. Over the next decade, RD&I will bear responsibility for ushering in the next wave of advanced, digitally-enabled devices such as new surgical robots, smart contact lenses, connected inhalers, neuroprosthetics and biostamps. Future RD&I will fuse Information and Communications Technology (ICT) with medtech, with AI driving both products and processes.

The function's position as the driver of product innovation within an organisation means that the skills required by RD&I professionals often overlap with other areas. These individuals need to understand how new products will be manufactured at scale, while knowledge of regulatory processes will enable early product de-risking. Additionally, RD&I will be key to implementing the sustainability agenda through the principles of circular product design.

Our industry engagement indicated that the macro-trends of Cyber Resiliency and Artificial Intelligence were likely to generate significant future skills needs in RD&I.

Cyber resiliency

How this trend will shape RD&I:

The need to safeguard new, digitally-empowered devices, as well as the data streams they generate, will create increased demand for cyber resiliency knowledge within RD&I. Cybersecurity will also play a key role in manufacturing processes.

Who will be most affected:

Both core RD&I teams and supporting IT will continue to be greatly affected by cyber security needs. Functions such as Regulatory Affairs and Manufacturing can also expect cyber resiliency to be a key factor in supporting submissions and production, respectively.

What skills needs will emerge:

Core cybersecurity skills will be required by RD&I teams, while senior leadership willl need to understand how cyber resiliency will impact regulatory timelines and post-launch support.

Artificial Intelligence

How this trend will shape RD&I:

AI will shape RD&I in two ways. First, products themselves are increasingly AI-powered; in 2020, the US Food and Drug Administration (FDA) approved over 100 AI powered devices.[47] Secondly, AI is increasingly deployed during development, to simulate outcomes, validate assumptions and assist with data analysis, accelerating overall timelines. This trend's impact will grow as AI use becomes more common.

Who will be most affected:

RD&I personnel working directly with AI-powered devices will especially need to keep abreast of skill needs, but AI-powered tools will see use in all aspects of RD&I. Even individuals who do not work in software or systems engineering will begin to use AI to enhance their RD&I processes..

What skills needs will emerge:

Leveraging AI will be required for those working with smart devices, while all personnel will need familiarity with tools such as large language models. Surgical robotics, diagnostics image processing, and laboratory results analysis are all non-digital health related areas that medtech Europe expects to be especially impacted by AI. [43]

"It's about AI in the products but also in development. We need to educate engineers to embrace AI; use it as a tool to accelerate development."

Medtech RD&I Expert

Other Trends shaping RD&I

RD&I skills needs will also be shaped by the Sustainability drive, advances in robotics, extended reality and materials innovation.

Sustainability and Circularity

Our industry engagement highlighted that Sustainability is key in the RD&I process, with experts noting the need for eco-product design skills that incorporate cradle-to-cradle thinking, sustainable packaging solutions and materials innovation.

Robotics

European patent applications prior to the pandemic showed robotics and automation were the third most common patent group (excluding digital health), just after materials and body data technology. Robotic products will continue to see applications in surgery, nursing care, and a wide variety of other healthcare settings, creating a need for RD&I professionals to upskill in this area. [48] RD&I in robotic processes will also be key in the shift to advanced manufacturing.

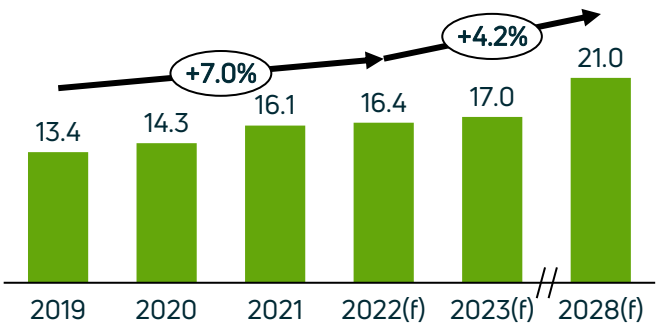
Extended Reality

Extended reality is an exciting new RD&I trend, particularly in surgical applications which Irish medtech stakeholders are beginning to leverage. The FDA has approved ~40 virtual reality empowered medical devices, mainly in orthopaedic and radiology applications. We expect its use to increase over the next decade, driving demand for skills in this area.

Technological trends

The ten largest medtech companies spent an all-time high of ~€16.1bn on RD&I in 2021, driven mainly by the pressure to address new medical needs. Potentially due to the end of the COVID-19 pandemic, RD&I spend growth is projected to slow from this rapid pace, gently inclining to ~€21bn by 2028.[49]

Historic and forecast (f) RD&I spend by the top 10 medtech companies[25], *€bn, 2019-2028, % in CAGR*



Medtech is an inventive sector, with the highest or second highest patents per field since 2018.[50] Ireland ranks favourably in RD&I, with the 8th highest per capita European patent applications.[21] The largest field for Irish inventors was medtech, at 22% of patents, a higher proportion than Germany (6%) or the US (15%).[31] Medtech patent data also helps to reveal potential future RD&I focuses: [48]

1. Materials innovation was the most cited trend in 2019, which includes biocompatibility, polymers, and other advances in materials. There is a particular need for materials skills training given the increasing restrictions on PFAS (per / polyfluoroalkyl substances) in manufacturing, including those proposed by the European Chemicals Agency.[75] Bioplastics are an exciting possibility, as these are sustainable, biocompatible, and often already FDA-approved as safe. They have particular disposable applications for medtech.[51.]
2. Body data technology products was the second most cited trend, including various types of sensors and other diagnostic / interventional technologies.
3. Automation and robotisation in treatment was the next most cited trend (excluding digital health).

Other RD&I areas include nanotech, microfluidics, and drug-device combinations. Consultees also noted the growing need for experts who could speak to software and hardware, given that medtech products are increasingly moving towards being "smart"; combining software elements and physical hardware devices. Premier examples of this include algorithm-driven insulin pumps, or advanced imaging devices.

> "For smart medical device development, there are two core skill sets; systems engineering and app software expertise. The former expert type is very rare."
>
> **Smart Device Expert**

Other Trends Shaping RD&I

In Ireland, the RD&I function identified skills needs in both technical areas, such as knowledge of specific product types like drug-device combination products and function enablement skills, such as business case development and leadership.

Global trends

Global trends indicate shortages in RD&I professionals, but not to the degree of other business units. Switzerland is an exception, likely due to its heavy focus on research compared to other international hubs.

Most difficult functions to hire for, globally

	Regulatory	Manufacturing	RD&I
52 (Massachusetts)	1st	5th	6th
53	1st	2nd	4th
54	2nd	1st	7th
51	1st	5th	2nd

Our survey of the Irish medtech workforce ranked Regulation, Manufacturing, and RD&I as the 7th, 9th, and 4th areas most urgently in need of upskilling. Digitalisation ranked 1st.

Skills themes in Ireland

Despite Ireland's RD&I strength, some experts expressed concern, stating the medtech footprint has historically been manufacturing, and to continue to grow the RD&I function in Ireland, additional upskilling in critical RD&I skills were needed.

RD&I professionals engaged for this report noted that the function is characterised by two skill groups. The first is rapidly changing, comprised of technical skills like drug-device combinations, smart device production and bioengineering knowledge. The second relates to perennial RD&I activities such as understanding regulation, as well as skills such as making the case for investment, leading a team in ambiguity, and communicating. Skills training in both is needed.

> "An RD&I leader is competent in their technical area, but fundamentally you must be someone who can make a business case and a pitch for further investment."
>
> **Medtech RD&I Expert**

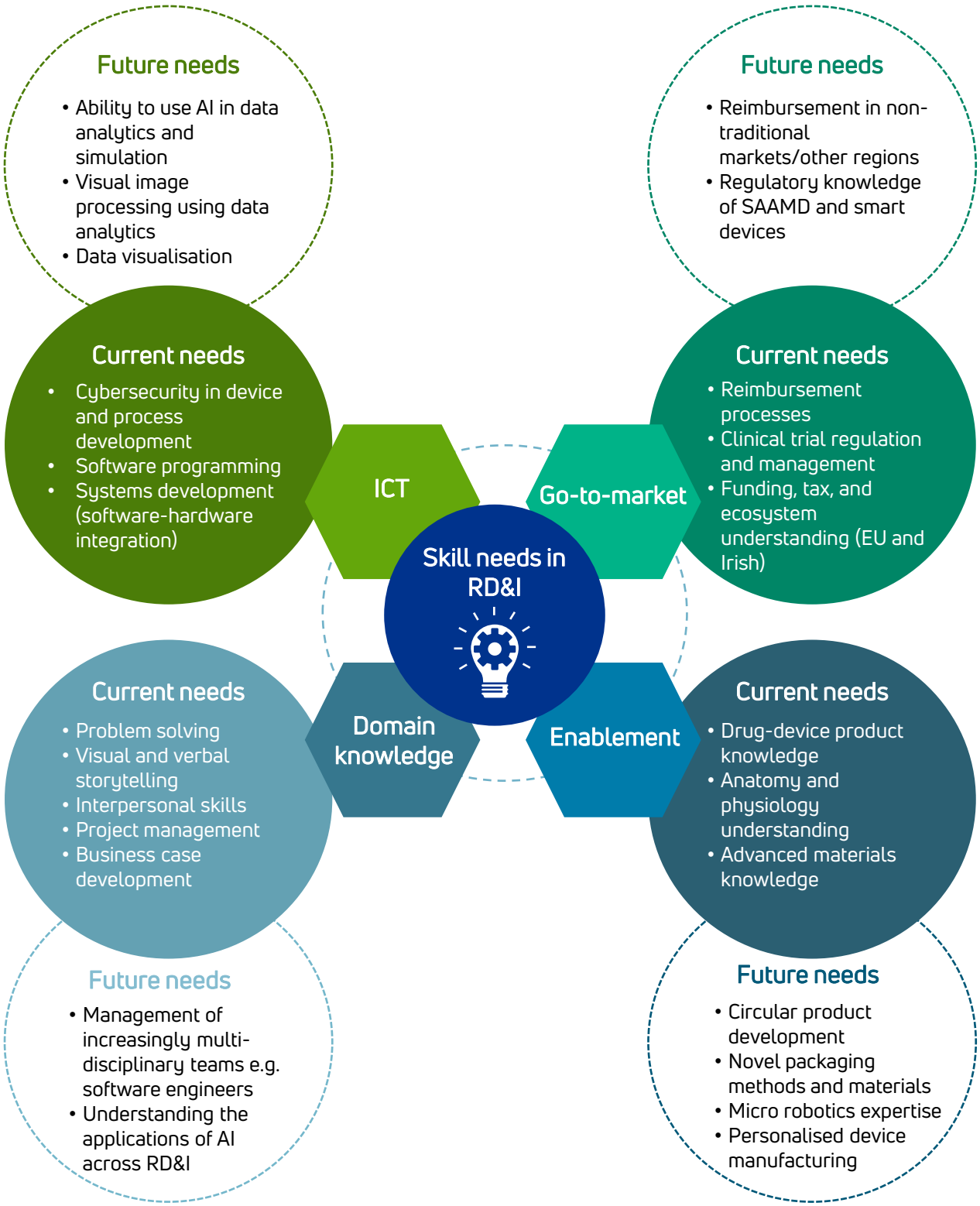
Key training challenges identified by industry across RD&I

- Instilling an understanding of needs-led innovation
- Developing leadership skill sets
- Understanding what skill set fits company's current stage of RD&I

Current & Future RD&I skills

RD&I professionals have clear skills needs in digitalisation, commercial and go-to-market knowledge, domain specific technical knowledge such as drug-device combination products and in transversal areas, such as project management and problem solving.

(The below skills needs are those prioritised by our industry engagement. Please contact the Irish Medtech Skillnet for additional skills identified.)



Current & Future RD&I skills

The major trends shaping the medtech sector, including AI and Digitalisation, globalisation, and the rapid progress of technology, have generated key skill needs for the RD&I profession.

Macro-skill: Information and Communications Technology

Medtech is undergoing a digital revolution, with new device types including "smart" versions of traditional medtech products, software as a medical device, and enhanced surgical tools which give data-driven digital or haptic feedback. Our industry engagement highlighted corresponding training is required in skills such as software development, cybersecurity, systems development, data management and analytics, and all related digital skills. Experts also highlighted the future demand for skills training in applying AI/ML in the development process as well as in the final product. This includes skills like large language model assisted data analysis, AI-validation of assumptions, and digital simulation. Needs around data visualisation for end-users (clinicians, patients) and processing of images such as X-rays are current, but will be increasingly required in the future.

The need for all forms of digital skills is pressing across RD&I, creating a clear need for training providers to act.

Macro-skill: Enablement and support

The RD&I process is technical, but it requires supporting transversal skills as well. Our research highlighted the skills required by senior RD&I personnel, including visual and verbal communication, leadership, influencing and project management, especially around scheduling and ensuring timeline adherence. Junior colleagues also require support, with our workshop noting that training aimed at the skills of presentations, creativity, communication, and managing deliverables would be welcome in helping these colleagues establish credibility and display value to their organisation. The workshop also noted smaller companies may be at the beginning of their RD&I journey and could benefit from additional training on proven processes and principles of innovation such as the BioDesign methodology.

Future skills include understanding the application of AI across RD&I processes, as well as managing ever more multi-disciplinary teams and cross-collaborations to bring new product types successfully through the development phase.

Macro-skill: Commercial and go-to-market

The commercial route-to-market for a medical device is complex and carries significant risk. Our industry engagement highlighted that RD&I professionals increasingly need an understanding of processes beyond development, such as the regulatory landscape, reimbursement and commercial activities.

Early-stage RD&I begins with skills including grant and tax incentives applications, while senior leaders will also need skills including business plan development and reimbursement likelihood assessment. These are key in in displaying to stakeholders how a return on investment will be obtained. Skills training around reimbursement was described as particularly required. As the RD&I process continues, needs shift towards skills such as clinical trial regulation and management. Clinical trial design and regulation understanding are other key skills that will assist approval of the finished product. In keeping with the globalisation of our world, key future skill needs will also include understanding of reimbursement and regulatory processes in major developing markets.

Macro-skill: Domain technical knowledge

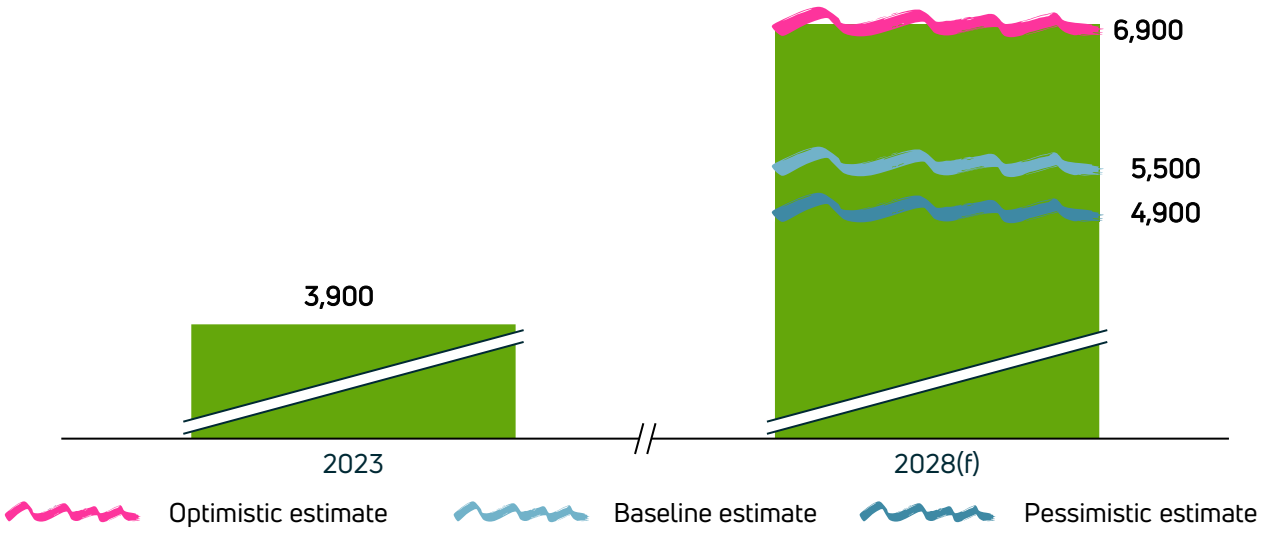
Alongside the new digital skills highlighted above, core technical areas of RD&I are also advancing, requiring new skills. Our research highlighted the need for training in the area of drug-device combination and materials, which are among the most cited areas in patents. Novel drug delivery approaches requiring technical skills include drug balloons, microbeads, and more. It was also made clear that engineers from non-bioengineering backgrounds also require skills training around anatomy, physiology, and another medical knowledge, so as to ensure they have full context during the RD&I process. As we move to the sustainable future of medtech, skills training will be required in novel packaging materials, minimal-waste packaging methods, and sustainable device design. This will incorporate both new materials such as bioplastics and new designs that incorporate circularity or minimisation of waste. Skills training will also be required to move towards personalised device manufacturing and advanced robotics.

RD&I Growth & Training Preferences

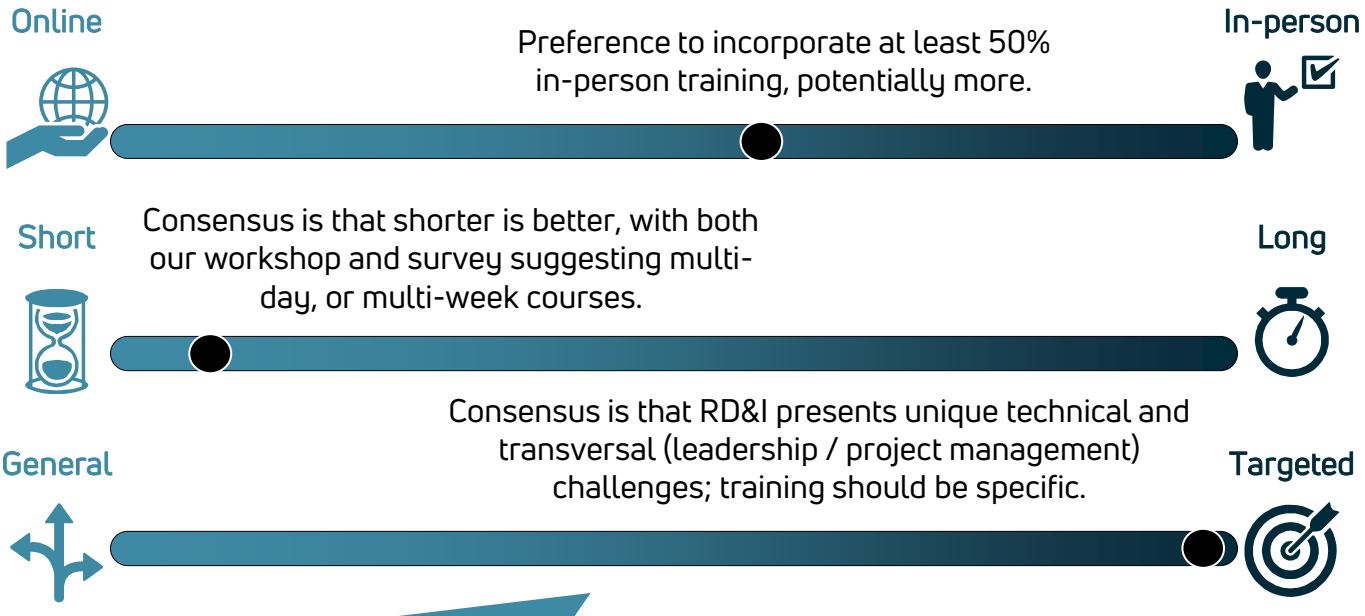
RD&I is forecast as the most rapidly growing function, with a potential 3,000 roles to be added by 2028. This function is likely to have some of the most pressing skill needs, based on its growth and should be a key focus area for those supporting the sector.

Forecast growth in functions related to RD&I[a]

Growth forecast from expected hiring activity by individuals employed in relevant functions, 2023-2028, optimistic, baseline, and pessimistic cases, data gathered as part of our survey of >400 employees in Irish medtech industry



RD&I course preferences



Workshop attendees also highlighted the high value of the "industrial PhD" model, where a graduate employed in industry spends 1-2 days a week in an RD&I centre. This is a potential solution to developing in-house RD&I experts who are capable of leading the development of innovative solutions in medtech.

Notes: **[a]** RD&I was the relevant function. Growth rate predictions from companies with less than 50 employees were discounted due to these companies having a different growth trajectory than the industry in general.

Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

Key Learnings for RD&I

There are significant opportunities to address the change in RD&I's digital skill needs, and account for the different skills needs of junior and senior research personnel.

The skill requirements for the RD&I function are evolving rapidly, mirroring the pace of technological innovation in the sector. Our engagement with RD&I professionals throughout this process supports this assertion, highlighting high demand for knowledge of new product types and technologies, such as smart medical devices. They also noted the function will benefit most from a targeted approach to training, ranging from addressing skills needs such as foundational physiological knowledge for early-stage employees, to focusing on advanced transversal skills for more senior levels.

What we learned	Recommendations
RD&I skills needs are rapidly evolving • All of our research, both desktop and industry engagement noted the shift from traditional devices to smart tech as a key driver of skill needs. • These naturally demand skills around product creation (i.e. software engineering, systems engineering) and adjacencies (cybersecurity, data management, data processing and analytics). • Drug-device combination products were frequently noted as an area with skill needs. • There is an increasing understanding that RD&I approaches must be needs-led and market driven.	The "industrial PhD" model, where an industry employee undertakes a 'researcher in residence' role, spending 1-2 days a week in an RD&I centre could possibly transform the Irish medtech sector as it could attract high-calibre global graduates to Ireland. This model should be implemented at scale to enable companies to pursue long term strategic RD&I projects. All experts highlighted that the demand for smart tech skills remains high, with more pipeline products than ever being either smart or incorporating software-based components. This area needs to be a high priority for RD&I skills training programmes[a].
Targeted upskilling for RD&I adjacencies • Our workshop highlighted that early-stage engineers entering RD&I from non-biomedical engineering backgrounds may lack some of the foundational anatomy and physiological knowledge needed to significantly contribute to the RD&I function. • At more senior levels, a key "big picture" thinker is needed who can communicate effectively, develop a business case, outline reimbursement, and plan clinical trials.	A short course explaining anatomy and physiology, including how devices are applied and used by clinicians and patients in the real world would be useful for junior employees to enable them to better design solutions that meet the end user's needs. Other early-career courses should focus on communication, confidence, and presenting, while senior training should be on business case development and route-to-market strategies.

Notes: **[a]** Software and data-driven connected health technologies have been the focus of a separate recent report on cross-sectoral digital health opportunities for the life sciences, entitled "Where Digital Health Thrives", published by Connected Health Skillnet.

Key Learnings for RD&I

Our industry engagement highlighted that medtech needs to begin reimagining processes and products to adapt to the Sustainability agenda. This comes with fundamental skilling needs for RD&I.

The ability to apply the principles of Sustainability in product design, process innovation, and other elements of the medtech life cycle will be key in helping the medtech industry adapt to the future. These efforts will not only reduce carbon footprints and help meet sustainable targets, but in and of themselves are likely to produce benefits to a company's operating model.

What we learned	Recommendations
Sustainability is a core element of the RD&I process 	• Sustainability in medtech product design is a concern driven by regulation and changing material / energy use; many experts noted medtech is in an early stage of addressing this. • The industry expects that sustainability shifts in both products and processes are coming, which will bring significant future skills requirements, particularly in RD&I.	Ireland's medtech industry needs to begin preparing for a shift to sustainably designed products now. Circular design, novel materials, and efficiency in packaging/material/ energy use are all areas in which RD&I professionals require skills training to address this future need.

"For sustainability in RD&I, a lot of people don't know yet how they can incorporate this into their day-to-day work. e.g. lifecycle analysis. It would be great if courses in this became more common and everyone understood this. Legislation is coming so we need to prepare our teams now. Training a critical mass will take some time."

Medtech RD&I Expert

"We need to design a product with sustainable packaging, know how it will be managed at end of life, and understand if re-usables are an option."

Medtech Sustainability Expert

"We need to take a holistic approach to the whole process of medtech. There's new solutions needed across the organisation, particularly around certain chemicals, and sterility."

Medtech Sustainability Expert

Notes:

[a] Software and data-driven connected health technologies have been the focus of a separate recent report on cross-sectoral digital health opportunities for the life sciences, entitled "Where Digital Health Thrives", published by Connected Health Skillnet.

Key Learnings for RD&I

In Ireland, support for RD&I skills development is robust and multifaceted, reflecting the commitment to fostering innovation and driving economic growth.

How industry can engage to support RD&I talent needs

There are a number of initiatives and programmes in place to support RD&I talent across all sectors in Ireland, including:

- **Government Funding and Grants**
- **Higher Education Institutions**
- **Industry-Academia Collaborations**
- **Skillnet Ireland**
- **European Union Funding**
- **Innovation Hubs and Incubators**

Addressing future skills needs in both the RD&I function, and the medtech sector more broadly will require a coordinated effort among several key stakeholders. Government and EU funding can provide essential financial support to ensure educational programmes and research initiatives remain at the forefront of technological advancement. Higher education institutions will play a critical role in ensuring the workforce is equipped with the skills needed to succeed in medtech, while industry-academia collaborations will provide practical experience to support educational learning. Innovation hubs and incubators create a platform for growth for new ventures, supporting the transition to a marketed product through commercially focused training.

Skillnet Ireland plays a crucial role in supporting the training needs of the ecosystem. For example, working with Irish Medtech, and drawing on insights from site managers and RD&I leaders across the medtech sector in Ireland, the Irish Medtech Skillnet launched the "Realise your R&D Ambition" report in 2019. This established the framework for the "Realise your R&D Ambition" 7-step program. The program was developed to offer practical advice on achieving and surpassing global RD&I goals, from Ireland.

The initial six steps are applicable to both foreign direct investment (FDI) enterprises and domestic indigenous companies, while the seventh step focuses in on adeptly navigating corporate frameworks and can be applied for indigenous companies navigating investment opportunities.

Based on insights gathered from industries participating in the "Realise your R&D Ambition" program, as well as feedback from employers, the network has recognised the necessity to establish further steps. These steps aim to empower companies to enhance their capabilities in RD&I. Consequently, in collaboration with BioInnovate, the network has introduced the inaugural "Essentials of Health Technology Innovation" program. This initiative program delves into fundamental BioDesign principles crucial for driving needs-led innovation in health technology. BioInnovate is a programme which focuses on the development of innovative needs-led medical technologies through collaboration between academia, industry, and clinicians and has accelerated the rate of medtech innovation in Ireland. New programmes such as the DigiBio Healthtech Innovation Fellowship will aim to support the next generation of health technology innovators and entrepreneurs.

Collaboration amongst the stakeholders providing these key initiatives and programmes is essential to continue to drive skills development across the medtech sector. A unified approach which addresses the future skills requirements identified in this report will continue to ensure the Irish medtech workforce is equipped with the skills needed for future technological innovation.

"I'd love to see even further collaboration with medicine and engineering departments across universities. We could incorporate RD&I aspects into university programmes and develop the networks even more."

Medtech RD&I Expert

08

Future Skills Needs: Manufacturing

Key Trends Shaping Manufacturing

As the industry prepares to shift to a data-driven state, the interlinked topics of automation and Digitalisation are driving manufacturing skills needs in Ireland's medtech sector.

The changing role of Manufacturing

Manufacturing is the largest area of employment in Irish medtech and faces urgent skills requirements around automation, digitalisation, cybersecurity, and artificial intelligence. Industry experts across all functions emphasised that medtech in Ireland is in a pivotal transformation, moving from manual or mechanised manufacturing of traditional medtech products into data-driven, digitally-empowered, robotic processes. The medtech portfolio is also evolving, with traditional medtech products replaced by advanced medical technology such as smart devices and new materials.

Automation and Digitalisation are two mutually reinforcing trends in the shift to advanced manufacturing. A key aim of advanced manufacturing is automation through advanced robotics, which is far from fully implemented. Two-thirds of the world's ~750 billion hours spent annually on manufacturing activities could be supported by automated processes.[55]

In addition to these two key trends driving Manufacturing skills needs, human-machine collaboration and human centric manufacturing will also be key elements in ensuring the vitality and vibrancy of the future medtech sector. Experts also noted the difficulty in balancing current skill needs while also adapting to future requirements.

> "Ireland is up there with Germany or any nation in terms of its readiness to make the leap to advanced manufacturing — we have the IT, we have the tech, we have the manufacturing base. We haven't brought it all together fully yet but the potential is huge."
>
> **Senior Medtech Executive**

Advanced manufacturing: Automation

How this trend will shape Manufacturing:

Medtech is undergoing a revolution, merging traditional engineering with automation. Automating tools such as Programmable Logic Controllers (PLCs) which control machinery on the floor can link in with real-time monitoring Supervisory Control And Data Acquisition (SCADA) control systems. When integrated to a Manufacturing Execution System (MES) which utilises the data, itself in communication with Enterprise Resources Planning (ERP) systems, a manufacturing floor can become a industrial networking automated system with all parts in communication. Skills for each step in the process and for interfacing with each of these tools are required.

Who will be most affected:

All functions will likely be affected to some extent, but Manufacturing and IT will see their skill needs greatly evolve as we move from manual to automated processes. There will also be key organisational challenges in implementation and transformation which will require senior leadership, potentially supported by Human Resources. Regulatory Affairs and Quality will also be key, as new process implementation has regulatory impact.

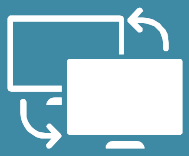
What skills needs will emerge:

Skills needs will emerge across all levels of the production process, both relating directly to automation processes themselves and to their introduction (change management). Cybersecurity risks will also emerge with the use of robotics, as will skills around data management, analytics and warehousing. Training in using multiple different robotic solutions will also be required, as will skills in human-machine interfacing.

Key Trends Shaping Manufacturing

Digitalisation of the production floor and the products manufactured have created new skills needs to support the implementation and integration of advanced sensors, vision systems, virtual servers, data warehousing, and artificial intelligence.

Advanced manufacturing: Digitalisation



How this trend will shape Manufacturing:

The shift to automated manufacturing will also drive the function's move to Digitalisation, as significant amounts of data will be generated during the manufacturing process. A Digitalisation-driven Industrial Internet of Things enables linkage between disparate processes in the factory and is a crucial step in moving towards an advanced manufacturing state.

Who will be most affected:

Our sectoral engagement made clear that Digitalisation will affect every function across medtech. Manufacturing will be a highly impacted function, but Supply chain / Procurement, IT, RD&I, Regulatory and HR will also see new skills needs emerge due to reliance on data.

What skills needs will emerge:

Although the process of Digitalisation is already underway, additional skills training is needed to accelerate its growth. This should focus around sensorisation and industrial vision systems to generate data, the virtual servers and data warehousing and analytics/visualisation skills to store and analyse it, and the artificial intelligence skills needed for analysis. Increased access to data will also drive skills needs in transversal skills, such as critical thinking, visual storytelling, and presentation.

Experts also highlighted there is a need to develop hybrid skilled individuals spanning traditional engineering and IT. For example, industry needs automation and controls engineers who are familiar with software coding and IT infrastructure, and vice-versa. Skills training that helps experts in one area adapt to a second will be key,

Digital twins

Digital twins are an exciting tool in medtech and other industries. A digital twin goes beyond a simple simulation based on historical or estimated data, and typically incorporates live data and insights from already- operating systems. Digital twins can simulate the effects of change, give key insights into overall equipment effectiveness and predictive maintenance under various conditions, and can even be used to give live feedback to the machinery used to inform the digital twin. As with all virtual solutions, they have key advantages, including:

1. The ability to experiment with processes or modify product specifications to implement necessary changes without needing to apply them in the real world..
2. Testing and validation can similarly be trialled virtually.
3. The solution can be scaled over time to encompass more activity and become a truer to life digital twin.

Given their uses in product and process refinement, skills needs around the creation, interaction with, and applying findings from digital twins are both currently required and will be into the future.

Human centric manufacturing

People are a key resource in all industries, and maximising the contributions of our talent will be key to Ireland's medtech sector's success. Human centric manufacturing (HCM) is an approach to manufacturing which aims at integrating both workers and technology solutions, ensuring that both are working cooperatively to drive organisational success. This approach enables change by also taking into account the viewpoints, culture, and practices of the medtech workforce in adopting technological change. Cultural factors and workplace practices can be a powerful driver of technological adoption. Conversely, failure to anticipate the needs of an organisation before attempting to introduce new systems is likely to create workplace difficulties. HCM-related skills around assessing workplace culture, ensuring healthy risk-taking, and integration of technology with people, will all be required in the future.

Virtual Reality in Manufacturing

Our industry engagement highlighted that creating opportunities and time for training was a major challenge to skills training, but this could be potentially solved using augmented / virtual reality. Freudenberg Medical is an example of a company in Ireland already successfully deploying this technology to solve its skills training needs in manufacturing.

Case study in virtual reality : Freudenberg Medical

AR / VR training has the potential to circumvent space limitations, avoid shutdown of production environments, and scale training solutions. International medtech hubs such as Singapore rate it highly as a teaching tool. Although it is a powerful technology, our discussions with Irish industry indicated AR / VR training was generally viewed as an interesting but unproven training solution. The case study on this page describes a real-life application of AR / VR training in Ireland by Freudenberg Medical, a global medtech design and manufacturing company. Freudenberg Medical was implementing complex manufacturing processes in its Irish facility and sought ways to bring its workforce to the level of skill required.

How it works

Individuals joining the company in production roles undergo VR training at an office desk, which replicates their position on the production line. Training is "gamified"; operators must complete their production line tasks and earn a certain score to complete their training. Training is finished in a live production environment; nevertheless, the overall training time is reduced by 75%. Only the most critical and technically challenging steps are VR-empowered currently, however given the major VR equipment investment has already been completed, there is a clear rationale to add further training modules.

Benefits and outcomes of AR/VR training

VR training was described to us as a "clear, rational" choice with rapid return on investment, including advantages such as:

1. Data-driven validation and standardisation of training, with an objective score on VR training used to ensure readiness for the line and benchmark performance over time.
2. Increase confidence for operators who could practice their skills without incurring any safety or cost risks before joining the production line.
3. Reduced defects by operators who had trained using the VR process, enabling long-term cost savings.
4. Ability to scale training both internally and to other sites due to the replicability of the training. After a successful pilot in Ireland, Freudenberg Medical chose to expand training to US sites.
5. Limited additional costs to introduce more training modules, with the only major expenditure occurring with purchase of the VR technology.

"Statistically, we show the operator level required...the gamification and scoring is also very appealing. Our operators even want to top the leader board."

Freudenberg Medical Representative

Key skills challenges identified by experts across Manufacturing

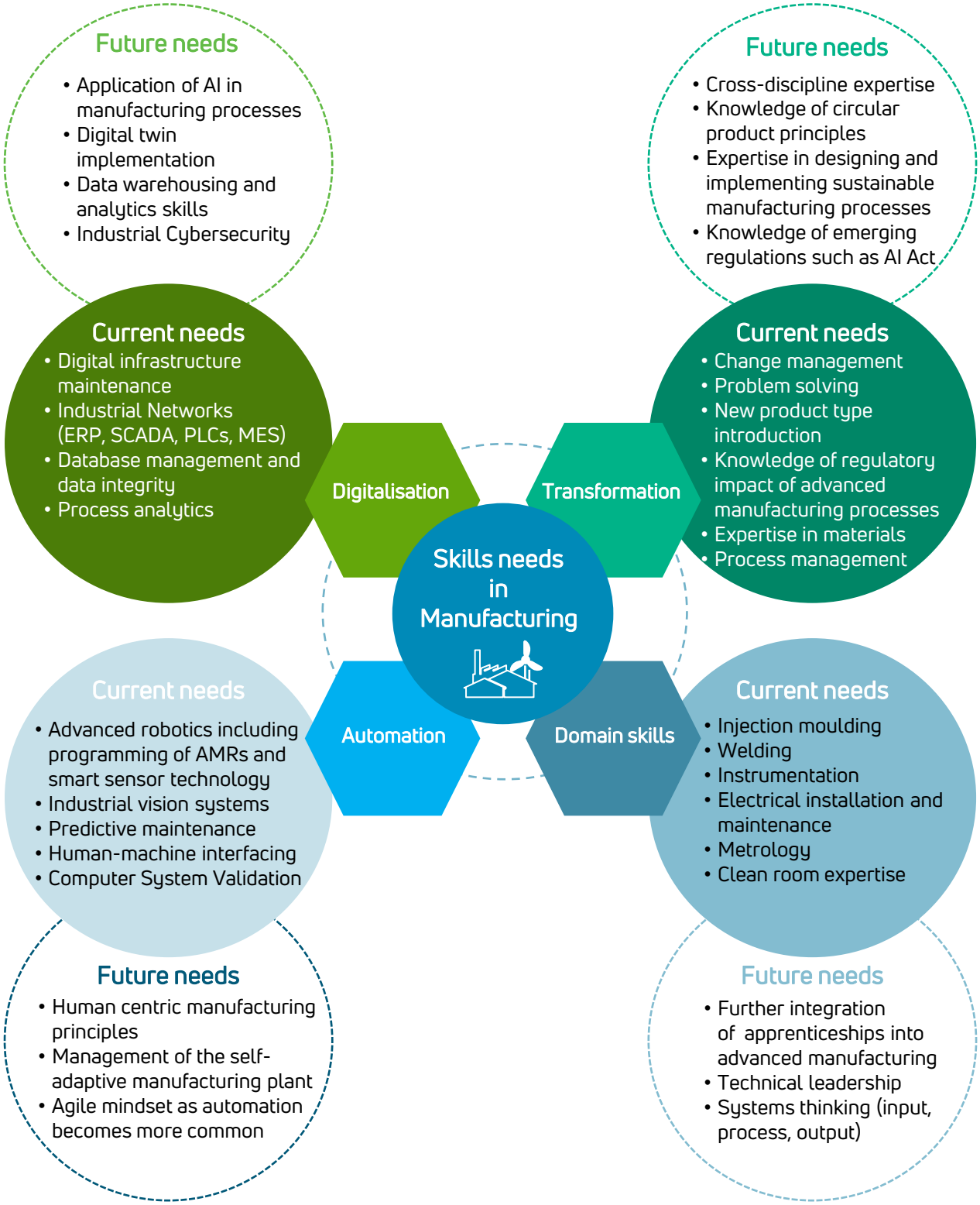
- Giving individuals time and space for training
- Encouraging manufacturing personnel to take on leadership roles
- Scaling apprenticeship adoption

Source: Interview with Freudenberg Medical personnel and publicly available documents, 2024. We would like to express our gratitude to representatives of Freudenberg Medical who shared their perspective on VR training.

Current & Future Manufacturing Skills

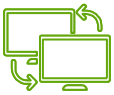
Skills training is urgently required across Manufacturing, with Digitalisation, Automation, and Data Analytics highlighted by our survey as the most urgent areas for training. Our focus group highlighted training in technical areas and transformation is also required.

(The below skills needs are those prioritised by our industry engagement. Please contact the Irish Medtech Skillnet for additional skills identified.)



Current & Future Manufacturing Skills

Digitalisation and Automation are two closely related areas in urgent need of skills training in manufacturing.



Macro-skill: Digitalisation

Our industry engagement made it clear that digitalisation requires more skills training support in Ireland for the potential of medtech to be fully unlocked. Skills in sensorisation and industrial vision systems are required to further accelerate the change, while skills including cybersecurity, database management, and process analytics secure, maintain and produce value from data generated during manufacturing. Skills in extended reality and virtual twins are also required, as these can provide potential spaces for training and process implementation which avoid impact on production.

We anticipate current skills needs around leveraging AI in manufacturing, digital twin use, and data warehousing and analytics will surge in importance as the medtech sector becomes more digitised. Skills training should immediately be directed at these accordingly, with an understanding that needs will build over time and will be guided by evolving AI regulations.

Macro-skill: Automation

Skills training is needed in all aspects of automation. Robotics in particular presents a broad skills group, with specific skills training needed in programming, maintaining, and understanding the uses of various robot types including six-axis, Cartesian, and autonomous mobile robots among others. Installing, maintaining, managing data outputs from smart sensors are also crucial, as these underpin the Industrial Internet of Things and enable automation to work. Industrial vision systems are another key part of the automated factory; skills needs here include computer programming and visual data processing. Finally, industrial cybersecurity skills are required to keep sensors, robots, and other connected devices secure. It is also vital to not omit the human element of automation. Human centric manufacturing skills will be required for its implementation, including designing human-machine interactions to be user-friendly, assessing the human elements of strategic change, and developing an automation-friendly workplace culture.

Macro-skill: Organisational transformation

Regardless of technological advances, skills needs including change management, problem solving, and new product introduction will remain relevant into the future. Our focus group also noted that Regulatory Affairs is a key stakeholder in introducing advanced manufacturing changes; as such, there are skills needs for both functions to better understand one another's priorities and requirements. Materials science is another area where skills are urgently needed, as the medtech industry shifts toward using more environmentally sustainable materials and substances.

As technology levels advance, there will be a greater requirement for individuals with a holistic knowledge of the entirety of the advanced manufacturing process*. This is a current need, set to intensify in the future. Our focus group also noted that Sustainability is a key skills area which will see much greater attention in the future. Skills including ESG (Environmental, Social and Governance)-related data gathering, and analytics, lean manufacturing, and circularity will be required to adapt to the ESG agenda.

Macro-skill: Domain skills

Our research suggests that although the future of medtech is in advanced manufacturing and smart devices, this will not remove the need for technical skills. Skills needs exist across injection moulding, clean room expertise, metrology, and different types of welding. In addition, the rise in more complicated machinery means more skill needs in maintaining, servicing, and installing these systems. As such, skills needs around electrical and instrumentation installation and fitting are also pressing.

In the future, shortages in currently needed skills will intensify as advanced manufacturing sees further adoption. Our focus group highlighted that there is a great and growing need for technically-minded leadership in medtech. As such, skills around managing apprentices and developing technical learning will be key. Leadership and strategy skills for technical personnel will also present as key skills needs.

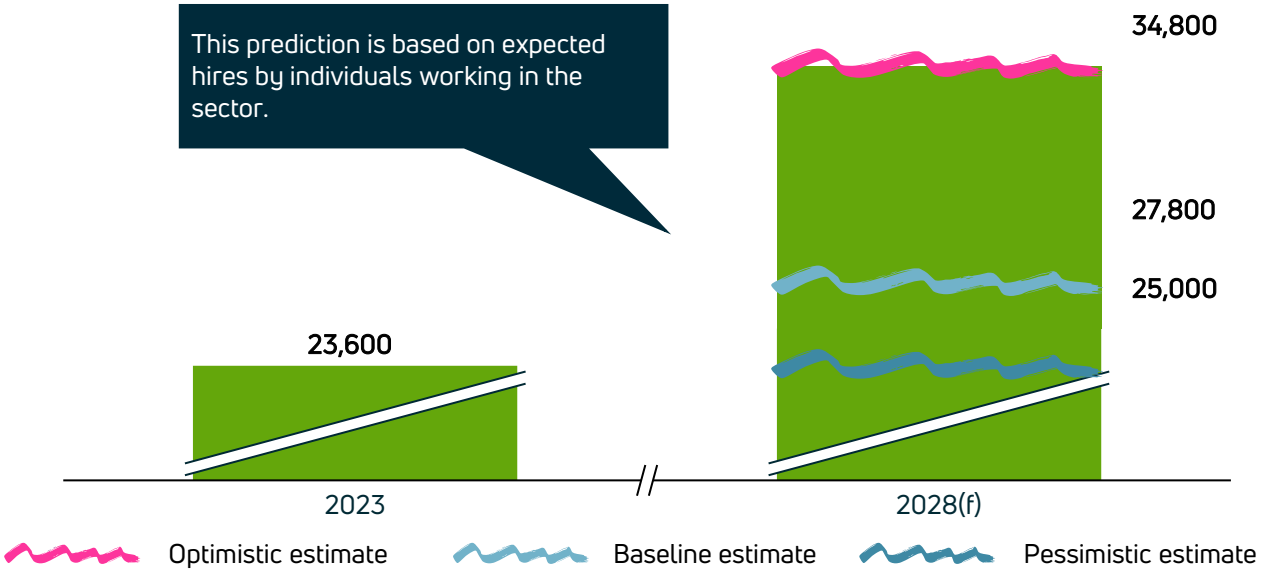
Note: *This refers to individuals who have a working understanding across all steps of the advanced manufacturing process for a product, and can begin the process of linking these disparate steps.

Manufacturing Growth & Training Preferences

Manufacturing is the largest area of employment in medtech in Ireland and will continue to require the bulk of upskilling needs, with as many as ~11,200 new hires expected by 2028.

Forecast growth in functions related to Manufacturing pillar [a]

Growth forecast from expected hiring activity by individuals employed in relevant functions, 2023-2028, optimistic, baseline, and pessimistic cases, data gathered as part of our survey of >400 employees in Irish medtech industry



Manufacturing course preferences

Online — **In-person**

Preference to incorporate at least 50% in-person training.

Short — **Long**

Our survey showed a preference for weeks to months long courses, but our workshop highlighted the difficulty in releasing employees for training over long periods of time.

General — **Targeted**

Acknowledgement that the highly technical nature of manufacturing requires specific training. Even transversal training should be orientated for those in manufacturing.

The manufacturing function requires training which is highly technical, specific and at least half of which is delivered in-person.

Notes: **[a]** Predictions of growth were derived from our industry survey. Growth rate predictions from companies with less than 50 employees were discounted due to these companies having a different growth trajectory than the industry in general.

Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

Key Learnings for Manufacturing

The shift towards advanced manufacturing will require significant attention to unlock Irish medtech's potential. Our experts highlighted advanced manufacturing skills needs are pressing across all elements of the transformation.

Manufacturing is in the midst of a pivotal change. The factory of the future will be automated, data-driven, and empowered by digitalisation. This change is causing acute new skills needs in Irish medtech, which our experts highlighted are currently only partially addressed.

What we learned	Recommendations
Skills are needed to further develop the data infrastructure, and to accelerate the shift towards advanced manufacturing	• Ireland is a major medtech manufacturing nation, but hubs such as Singapore have pulled ahead on elements of automation and digitalisation. • There is also a lack of experts who understand how these big themes fit together and can be appropriately implemented in a manufacturing site. • Our survey results indicate an immediate need for skills in project management to implement digitalisation processes, while skills in data analytics, though essential, are less critical at this stage. This aligns with insights from our industry focus groups, suggesting that the sector is currently focused on projects to accelerate the digitisation of manufacturing processes. Skills needs stemming from digitalisation, include enhanced data analysis capabilities, as a direct consequence of this ongoing transformation.	✓ Skills are needed across all elements of advanced manufacturing; from new product and process introduction, digitalisation, and automation. ✓ Training for manufacturing professionals should initially include a greater level of digitalisation skills, including cybersecurity, moving over time to favour more data handling, AI-powered analysis, and similar skills.

"Ireland has been strong over the past two decades in growing and building a manufacturing ecosystem. We have a firm foundation to shift to advanced manufacturing."

Medtech Manufacturing Expert

"We have run leadership courses for digitalisation, part-online, part in-person, with a project implementation aspect. Combining both theory and practice has been very successful."

Medtech Manufacturing Expert

Key Learnings for Manufacturing

Future skills development should account for medtech's current requirements and constraints while also being ambitious enough to fuel the advanced manufacturing transformation. There is particular scope to further expand apprenticeships and technical talent pathways.

Our experts highlighted that novel training tools and techniques will need to be adopted in order to ensure the workforce can be trained in a manner which does not impact production. The utilisation and development of AR/VR training provides a potential solution to this problem, as well as a safe, consequence-free environment for the testing and validation of training. Apprenticeships, under the support of programmes such as Generation Apprenticeship, are another area where training could further expand.

What we learned	Recommendations
Skills development needs to occur in a space where production is not impacted 	• Stakeholders highlighted the difficulty in training, given the high-risk of allowing untrained personnel into a live production environment, coupled with the inability to pause production for training purposes. • Despite VR being identified as a valuable mainstream training tool by international consultees, Irish experts consulted in our focus group had limited experience on the use of VR technology for training, and as such noted the industry generally views AR/VR training as a yet unproven approach. However, they agreed it could provide a partial solution if strong, clear commercial benefits were outlined with use cases. In this report, we have provided an example on page 62 from Freudenberg Medical who have successfully deployed VR training in their Irish manufacturing site.	✓ VR training is one solution to minimising production impacts when training. Digital twins, virtual testing and validation are other possibilities that should be explored. ✓ Additionally, there was interest in cross-skills development between Regulatory and Manufacturing to ensure new manufacturing initiatives can be implemented from a regulatory viewpoint, especially given MDR and advances in manufacturing technology. This similarly would avoid an impact on production.
Apprenticeships are a viable but underutilised source of talent 	• All stakeholders highlighted a preference for more apprenticeships and technical training pathways, with clear agreement that practical experience is invaluable for entrants into the medtech industry. • Experts also noted that it is difficult for any medtech company, but particularly SMEs, to know how to properly support apprentices and how tfurther build this pipeline of talent.	✓ Existing apprenticeship programmes should be scaled, with future training to focus around the needs of advanced manufacturing. ✓ There is also scope for funding supports to change, potentially with a view to offering more company support. The UK system, where levies paid by a company is reserved for that company to finance apprentices on a "use-it-or-lose-it" basis, is one particular funding model that could be explored.

Key learnings for Manufacturing

In Ireland, support for skills development in manufacturing is facilitated through a range of educational partnerships, apprenticeships and dedicated training and workforce initiatives.

How industry can engage to support manufacturing talent needs

As manufacturing shifts towards an advanced, digitised state, a significant need will emerge for individuals with corresponding skills to support their organisation's digital transformation strategy. Industry can find support for building this manufacturing skill base in Ireland through a range of initiatives and collaborations, such as:

- **Apprenticeship Programmes:** Including the Manufacturing Engineering Apprenticeship programmes (L6 to L8).
- **Partnerships with Educational Institutions:** Collaborate with universities, technical colleges, and vocational schools to develop curriculum that aligns with the skills needed in the manufacturing sector.
- **Training and Upskilling Programmes:** Examples offered by the Irish Medtech Skillnet are the Bachelor of Science in Process Instrumentation & Automation (L7) and the Bachelor of Engineering in Advanced Manufacturing Systems (L8). These enable existing employees to enhance their skills and stay updated with the latest technologies and practices in manufacturing. Skillnet networks across Ireland provide training to support Manufacturing, notably the First Polymer Skillnet have a centre of excellence to support polymer technology for Manufacturing within Medtech and other sectors.
- **Workforce Development Initiatives:** Industry associations and government agencies collaborate on skills development. In an example from the Irish Medtech Skillnet and its promotional organisation Irish Medtech, the Advanced Manufacturing working group led the development of a Masters in Digitalisation of Manufacturing. This course includes modules on Database Design & Data Visualisation, Cyber-Physical Systems & IoT, Data Analytics & Machine Learning.

The Irish medtech sector boasts a rich ecosystem of support for advancing skills in manufacturing capabilities. Leveraging these resources can future-proof the workforce, ensuring that manufacturing in Ireland not only adapts but thrives in the era of advanced manufacturing.

"Advanced manufacturing is very important for Ireland and will continue to be in the coming years. The transformation is only just beginning."

Medtech Manufacturing Expert

"The future for medtech in Ireland is in advanced manufacturing, implementing AI, and eventually the lighthouse factory, bringing forth a new revolution within medtech manufacturing."

Medtech Manufacturing Expert

09

Future Skills Needs: Regulatory Affairs

Key Trends shaping Regulatory Affairs

Regulatory Affairs needs to keep pace with the rapid rate of technological innovation and the changing regulatory landscape in Europe and elsewhere. The rise in global markets and the digitalisation of medtech are creating urgent skills needs in this function.

Changing regulatory skills

Regulatory Affairs is a strategic function within medtech which interfaces with nearly all other areas, from initial portfolio planning to guiding manufacturing in maintaining compliance with international standards. Although existing core regulatory skills knowledge will remain in-demand, new, digitally-enabled product types, such as smart devices, SMAAD, robotics and augmented reality navigation systems are driving the need for the function to have an increased knowledge of software development, cyber security and AI/ML. Developments in the field of regenerative medicine, such as bio-implants for orthopaedics will increasingly create a need for advanced materials knowledge. Additionally, the MDR and IVDR are creating significant skills needs both in Regulatory Affairs and more broadly across medtech. The rise of new global markets and digital health were highlighted by industry as macro-trends significantly impacting skills needs in this function.

Rise of global markets

How this trend will shape Regulatory Affairs:

The G7's share of world GDP was ~44% in 2000; it now stands at ~30%, mainly due to major economic growth in China and other emerging markets such as India.[56] Although developed markets will remain the most vital for some time to come, the size and increasing life expectancies of countries such as China and India will naturally lead to an increasing focus on regulatory submissions in global markets.

Who will be most affected:

Regulatory Affairs will be one of the functions most affected by the emergence of new markets, although needs are likely to scale steadily, rather than surge.

What skills needs will emerge:

Our focus groups highlighted that skills needs around local regulatory submissions, with particular emphasis on China and India reimbursement, and post-market surveillance will be required, as will customs knowledge and import requirements.

Digital health

How this trend will shape Regulatory Affairs:

The increasing connectivity of technology is leading to exciting healthcare developments; the delivery of healthcare in the form of digital therapeutics, the ability of "smart" devices to generate data and even make decisions based on it, wearable tech that tracks our health and improves our wellbeing, and the emergence of the smart factory.

Who will be most affected:

There are few roles in medtech which are not undergoing change due to the rise of hyperconnectivity and the digitalisation of health. Regulatory professionals will be particularly impacted due to their need to understand the clinical and functional aspects of these products when navigating the regulatory landscape.

What skills needs will emerge:

The emergence of new types of technology has led to new skills needs in Regulatory Affairs. Industry engagement highlighted these will be data-driven, including regulation of software as a medical device (e.g. software bill of materials), post-market surveillance using device-generated data, and cybersecurity as part of the regulatory submission.

> "I'd like to see Regulatory Affairs become a business partner in medtech. Interlinking regulatory knowledge across other departments and offering them our expertise would be powerful."
>
> **Medtech Regulatory Affairs expert**

Other Trends Shaping Regulatory Affairs

The MDR/IVDR are continuing to cause difficulties for Irish and international medtech firms. Switzerland's pivot to the US and the FDA's move to simplify its regulatory requirements indicate the growth in importance of US registration. This evolving landscape will shape the future skills needs of the regulatory function.

Artificial intelligence

In March 2024, the EU Parliament approved the world's first regulation of AI, the AI Act.[57] AI systems used in medtech would be categorised as "high-risk", and will encounter regulations around safety, privacy, and traceability. The Act is not expected to impact medtech until 2027, but organisations should consider such upskilling in AI regulations now.

Advanced product categories

The number of regenerative medicine products, such as orthobiologics and bone graft substitutes are increasing. Consequently, medical devices may have a biological component, such as recombinant human proteins embedded in a scaffold. These products will create new skills needs in regulatory professionals, such as advanced materials knowledge and technical expertise in drug-device combination products, drug eluting stents, and diabetes pumps.

EU regulatory developments

The EU MDR and IVDR

The EU's Medical Device Regulation (MDR) and In-Vitro Diagnostics Regulation (IVDR) came into force in 2021 and 2022, respectively, although transition periods have been extended to 2027/28.[58] [59] The regulatory burden has increased for manufacturers and other medtech players, mainly via new requirements for clinical performance evaluation, post-market surveillance, unique device identification labelling (UDI), and a leap in the number and/or burden of notified body assessments. One has been the effect on new product launches in the EU, with one survey showing ~90% of medtech executives intend to prioritise the US for future launches. ~25% intend to apply for Japanese and Chinese registration prior to launch in the EU.[60]

The European Health Data Space

.In 2024, the European Parliament and Council also reached agreement on the European Health Data Space (EHDS). This is intended to enhance electronic health record data sharing across the EU, as well as grant individuals greater control over their own data. It will also provide a system for the use of health data for regulatory purposes. As such, the Regulatory Affairs function will likely have skills needs in the applications of, and adherence to the EHDS.[61]

US regulatory developments

FDA moves to regulatory alignment

In February 2022, the FDA announced a proposed shift in its current medical device quality requirements.[62] Under the proposed rule, the FDA would incorporate ISO 13485 as the standard for quality management, rather than remain under the US-developed 21 CFR Part 820. The two systems are already more similar than different, but an alignment would further reduce US regulatory burden. Regulatory Affairs must nevertheless remain keenly aware of any changes in US regulation.

Remote regulatory assessments

The FDA shared in July 2022 its draft guidance on remote assessments of regulatory compliance for medtech companies.[63] A remote assessment is expected to mainly consist of sharing information on quality management systems and records on the facility. These new assessments are not inspections, nevertheless, the FDA has warned that it may not be able to make a "timely decision" on regulatory approval without conducting one. The regular guidance updates from FDA will ensure that RA professionals need to continue to be aware of the changing requirements and their interpretation.

UK regulatory developments

The post-Brexit UKCA mark

Before the UK's EU Exit, regulatory harmony enabled European manufacturers to sell CE-marked devices in the UK. The UK has stated it will seek to develop a new regulatory system, underpinned by the UK Conformity Assessment (UKCA) mark. The UK has now agreed CE-marked devices can be placed on the market until 2028. Regulatory divergence will subsequently occur if the UKCA is implemented. The exact requirements of UKCA are yet to be defined however they are likely to produce new skills needs for the Regulatory Affairs function.

Regulatory Affairs skills needs globally

Our survey revealed over one third of the medtech workforce felt urgent skills needs exist in Regulatory Affairs. Globally, UK and EU SMEs are finding the MDR particularly challenging to interpret and implement; Ireland should move to prevent similar difficulties through the delivery of targeted training, which reflects the global nature of the industry.

Europe

Regulatory Affairs is an in-demand function, with key medtech regions such as France, Germany, Switzerland, and Massachusetts ranking it either the 1st or 2nd most difficult function to hire in. Our survey indicated the Irish medtech workforce in general viewed Regulatory Affairs skills training as a medium priority among other functions. A substantial 36% felt it was a high urgency skills need. Industry experts noted that a broad array of Regulatory Affairs courses and educational offerings already exist in Ireland, including the Irish Medtech QA/RA forums and events held by the Irish Medtech Skillnet. Nevertheless, some international hubs have launched initiatives which may have some learnings for Ireland.

European Union

Evidence from Medtech Europe suggests that SMEs are having particular difficulties with the MDR, submitting needed technical files and Quality Management System (QMS) certificates at about half the rate of large companies.[64] SMEs may also be particularly vulnerable to regulatory holdups, due to their inability to endure protracted timelines. Ireland should move to stymie similar difficulties through regulatory upskilling specifically aimed at SMEs.

United Kingdom

UK medtech companies are grappling not only with new requirements at home, but also the increased burden of the MDR. Accordingly, UK medtech SMEs reported "Regulatory and Quality" as the second most common skills gap (20% reporting difficulty), just behind digital skills such as software / AI (28% reporting difficulty).[65] Proposed solutions included better links to The Organisation for Professionals in Regulatory Affairs (TOPRA), to enhance global learnings. A joint initiative between UK Research and Innovation, the Association of British HealthTech Industries, and CPI (a UK RD&I centre) is the "Regulatory Roadmap" series. These are brief pre-recorded sessions and live "Ask the Expert" webinars, updated on a quarterly basis.

The idea is to produce a low-burden learning approach for SMEs, who can join webinars for basic information as their regulatory needs ramp up.[57] As difficulties emerge in Ireland, similar approaches could be taken to share learning and ensure skills gaps are addressed.

"It has been very frustrating, having to withdraw product lines and delay launches. We don't have a skill problem in our company, there's just large backlogs with regulators when we do submit."

Senior Medtech Executive

"Globally it's challenging to build regulatory capability. The requirements per country are so specific and becoming more and more stringent. Demand for regulatory professionals simply outstrips supply."

Medtech Regulatory Affairs Expert

"In an industry like ours there will always be a demand for new skills training and regulatory jobs."

Medtech Regulatory Affairs Expert

Regulatory Affairs in Ireland

Regulatory Affairs in Ireland needs to keep pace with the rapid rate of technological innovation and the changing regulatory landscape in Europe and elsewhere. The rise in global markets and the digitalisation of medtech are creating urgent skills needs in this function.

Regulatory Affairs Skills Needs for Global Markets

Irish Regulatory Affairs teams are often responsible for products spanning multiple global markets, including Europe, the US, and China. Despite significant disquiet over recent EU regulations, experts generally felt that these were either being met, by introducing new processes around quality and risk management, or being avoided, by withdrawing legacy and niche devices from the market. Experts also noted a role in Regulatory Affairs is one of the few medtech roles where part-time remote working is a possibility. As such, immediate skills requirements have been partially addressed.

An increase in European regulatory skills needs will eventually emerge in three ways. Given the extension of the transition period to 2027/28, we expect the changes to take some time to impact companies.

1. The increased regulation of the MDR, including new post-marketing, clinical, and quality requirements, will lead to increased workloads per each device.
2. These changes will particularly affect IVDs, with the EC estimating that ~80% of IVDs will require notified body oversight, up from ~10% currently.[66] An eightfold surge in IVD diagnostic regulation will require new personnel trained in IVDR.
3. The MDR has presented a particularly challenging regulation, due to some ambiguity on its exact interpretation. It can be expected that continuous skills training will be required accordingly as European legislation continues to evolve.

However, Irish medtech has a global scope. The US remains as the largest medtech market, and continuous upskilling in US regulation will be required going forward. Closer to home, the divergence in Swiss and UK regimes from the EU will require new skills to attend to these markets, which imported €6.3bn and €8.8bn of medtech in 2021, respectively.[51, 67] Similarly, a rise in the importance of global markets such as China means Ireland should further invest in training to ensure its continued relevance to global medtech companies.

Irish and international experts also noted the high-level of regulation has historically been off-putting to new hires from other industries. Upskilling efforts could similarly address this hurdle to sourcing talent from other industries.

In addition to technical skills requirements, we also anticipate Regulatory Affairs professionals will have skill needs in transversal areas, such as influencing, negotiation and interpretation skills to enable them to effectively navigate this complex regulatory environment.

These skills will further enable the function to input elsewhere in the business. For example, changes in Manufacturing will rely on regulatory considerations as well as business ones. As such, transversal skills such as stakeholder management and communication will be required to enable Regulatory Affairs to input effectively. A basic understanding of new manufacturing processes for Regulatory Affairs professionals will also be crucial.

Key challenges identified by industry across Regulatory Affairs

Ambiguity over exact requirements of new regulation

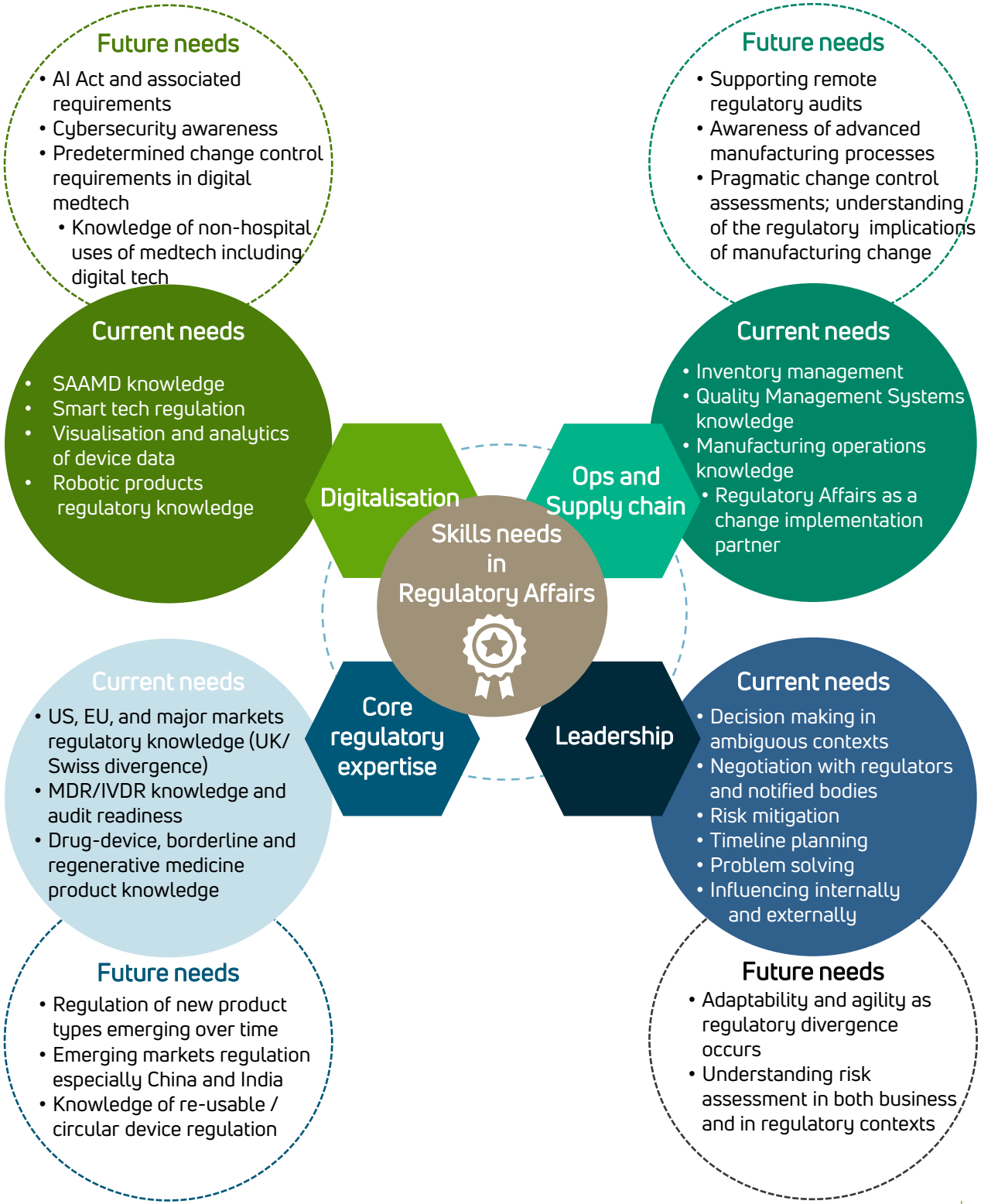
Attracting external talent into Regulatory Affairs

Inability to capitalise on the data being produced by new smart medtech and software

Current and Future Regulatory Affairs skills

Regulatory Affairs skills needs are driven by digitalisation, the needs of manufacturing, core regulatory expertise, and the need for the function to further develop as an interactive and collaborative business partner within each company.

(The below skills needs are those prioritised by our industry engagement. Please contact the Irish Medtech Skillnet for additional skills identified.)



Current and Future Regulatory Affairs skills

Pressing skills needs exist in Regulatory Affairs, driven by the emergence of new product types, new markets, and new regulatory requirements.

Macro-skill: Digitalisation knowledge

Medtech's new product types including "smart" versions of traditional medtech products, SAAMD, AI-powered technology, and augmented reality products have and will continue to generate extensive regulatory requirements. Our focus group highlighted the complexity of corresponding skill needs. Skills training is required in regulatory aspects of cybersecurity, displaying software safety and controlling changes, and other digital skills. There is a key opportunity in the new data being generated by digital products, which experts also highlighted the Regulatory Affairs function is well placed to capture, have stewardship of, and analyse. Skills training in data capture and analysis could enable the function to deliver impact in this new area.

The emerging EU AI Act and the European Digital Health Space will also generate skills needs in their specific implications on company portfolios. The future Regulatory Affairs function will need skills training accordingly, likely to be staggered over time as new elements of these changes are implemented. .

Macro-skill: Core regulatory expertise

Digital medtech will be key in the future, but industry experts noted that the majority of medtech will continue to be traditional for some time to come. As such, core skills cannot be neglected. Skills training is required in core skills including knowledge of the MDR / IVDR requirements and audit readiness, trade and customs compliance in key markets such as the US, and how to distinguish between genuine medical devices from borderline cases which fall outside the MDR. In addition, new and advanced product types such as drug-device combinations will generate additional skills needs.

In keeping with the increasing relevance of global markets, our focus group expects skills deficits to emerge regarding new markets. Accordingly, skills training will be needed to adhere to regulatory requirements, make reimbursement applications, and import medtech products into these new markets. India and China were highlighted as two markets which will particularly grow in importance.

Macro-skill: Operations and Supply chain

Medtech is among the world's most regulated industries, and Regulatory Affairs provides key support to ensure products meet this high regulatory burden. Our industry engagement highlighted knowledge of quality management, inventory management/supply chain and supplier negotiation and change control as areas that need to continue to be fostered in Regulatory Affairs. We also heard from Manufacturing experts in the that although they often hoped to introduce new or improved processes, support was needed from Regulatory to ensure this could occur. Regulatory experts were acutely aware of this, and noted Change Control skills training would be valuable to enable the move to advanced manufacturing. The increasing prevalence of remote Regulatory assessments produces another key area for skills training, in ensuring Regulatory Affairs is "remote audit ready".

Our focus group noted that we cannot predict exactly how medtech will look in the future, or what exact healthcare settings it will be applied in. As such, skills training will have to be carefully developed and deployed as new healthcare settings emerge and new markets are entered. Regulatory Affairs will likely be the function which communicates any new requirements to other areas of the business.

Macro-skill: Leadership

Regulation is a technical skill, but our industry engagement also emphasised the critical application of leadership as a transversal skill required by Regulatory Affairs professionals. Skills needs include the ability to draw timelines from regulation, negotiate with notified bodies and regulators, make decisions in the absence of certainty, plan for risk mitigation, and solve problems.

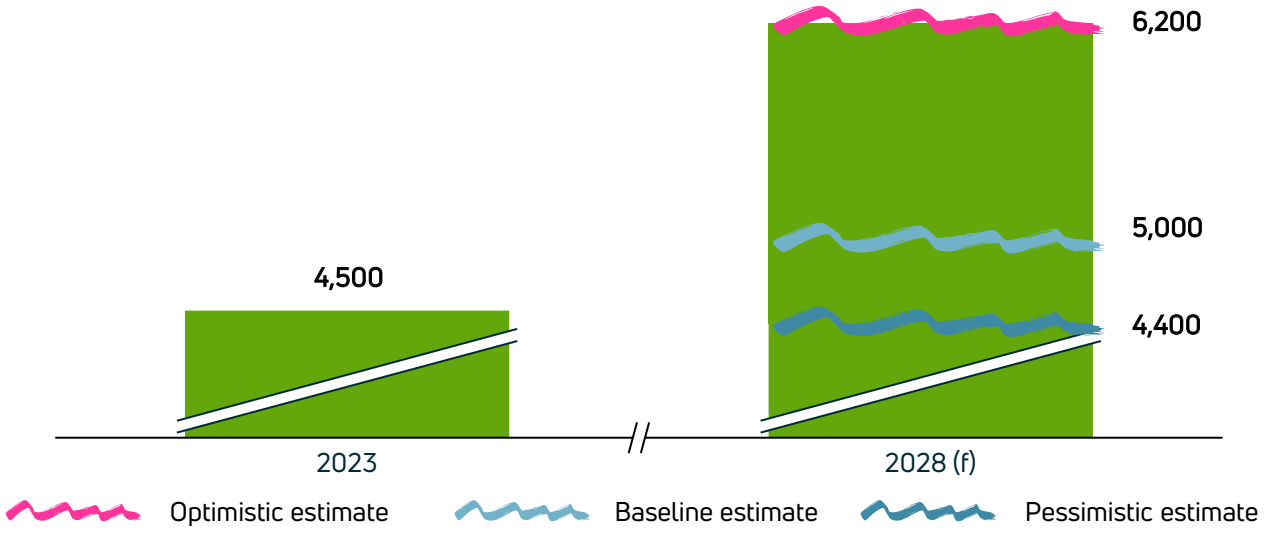
The partial ambiguity of the MDR was cited as an example of something that challenged both Regulatory Affairs professionals but also the broader business leadership. One opportunity is for RA professionals to become strong business partners with influencing and strategic skill sets, enabling them to cooperatively input on organisational wide change. Our focus group noted the opportunity for corresponding skills training in the future to ensure Regulatory Affairs leaders and their teams are strategic business partners

Regulatory Affairs Growth and Training Preferences

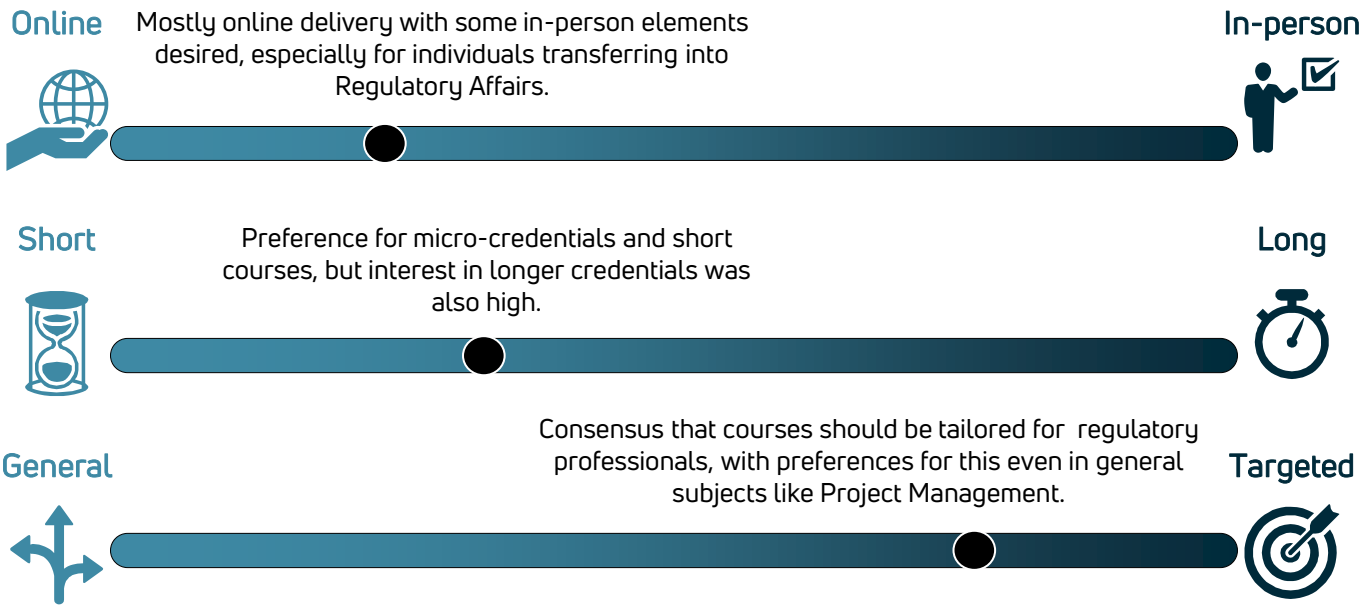
The Regulatory Affairs function is forecast to require as many as 1,700 hires by 2028. Respondents wanted flexibility and the majority of content delivered virtually without eliminating in-person elements, especially for those transferring into the function.

Forecast growth in functions related to Regulatory Affairs[a]

Growth forecast from expected hiring activity by individuals employed in relevant functions, 2023-2028, optimistic, baseline, and pessimistic cases, data gathered as part of our survey of >400 employees in Irish medtech industry



Regulatory Affairs course preferences



The demand for Regulatory Affairs professionals is set to rise with new legislation affecting medical devices in Europe and other global markets. Expanding online upskilling courses is a scalable method for meeting this increased demand in line with the function's preference.

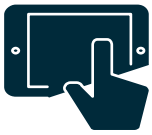
Notes: **[a]** Relevant functions include Regulation and Quality. Predictions of growth were derived from our industry survey. Growth rate predictions from companies with less than 50 employees were discounted due to these companies having a different growth trajectory than the industry in general.

Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

Key Learnings for Regulatory Affairs

Our analysis notes skills needs in areas such as digital products, support for the Operations and Supply chain functions, leadership, and regulation in new markets. With appropriate training, the regulatory function can become a strong business partner within the organisation.

The importance of the Regulatory Affairs function across an organisation, with involvement spanning initial portfolio planning through to supporting the manufacturing function in maintaining compliance means that it will have significant future skills needs as the sector adopts new technological innovations and shifts fully towards advanced manufacturing processes. With time, our findings suggest that an empowered Regulatory Affairs function will become a critical strategic partner within the organisation, with corresponding training needs emerging in transversal skills such as leadership, communication and negotiation techniques.

What we learned		Recommendations
Digital products are creating new skills needs 	• The need for skills around smart tech, SAAMD, and digitalisation are still urgent. • Many experts mentioned that Ireland's technology sector could provide a digitally skilled workforce. • Our workshop highlighted that although digital needs are the most urgent, most devices on the market will continue to be traditional for some time. Regulatory Affairs must balance the needs of the future with those of the past.	Core regulatory upskilling needs to focus on smart devices and software. It is challenging to attract technology personnel into medtech. Skills training aimed at a "Technology to medtech" cohort, focusing on the regulatory aspects of the industry, could help bridge the gap. Our workshop suggested these be in-person. Additional regulatory training around the AI Act and European Health Data Space will also be required.
An empowered Regulatory Affairs department could become a greater strategic partner within medtech	• Our workshops and interviews made clear that Regulatory Affairs has a lot to offer other medtech functions, with senior leaders in "Quality Assurance and Regulatory Affairs" (QARA) roles offering support across Quality, Regulatory, and procurement. After digital skills, transversal skills were prioritised most highly in our workshop. • Regulatory Affairs can play a larger role as a strategic business partner in medtech.	Skills training in project management, pragmatism and leadership for senior leaders is necessary as they look to add value outside their core function. As Ireland's competency in smart technology and digitalisation progress, regulatory affairs training providers can develop training on the regulatory aspects of introducing advanced manufacturing processes into the business.
Anticipating the future	• Consultees noted that three trends are likely to continue; the rise of developing markets, ongoing digitalisation (and more non-hospital applications of medtech), and new technologies.	Regulatory Affairs skills training will be needed for India and China. With time, other key markets are likely to emerge and grow in relevance to Irish RA professionals.

Key Learnings for Regulatory Affairs

The medtech industry in Ireland can access support for talent and skills development in Regulatory Affairs and Quality Assurance by tapping into the various resources and programmes offered by government bodies, educational institutions, and industry associations.

How industry can engage to support Regulatory Affairs talent needs

There are a range of supports available which the medtech sector in Ireland can leverage to support skills development in this function, which include:

1. Leveraging Government Initiatives and Funding

The Irish government offers various programmes to support skills development in the Medtech sector. Skillnet Ireland is a business support agency dedicated to the promotion and facilitation of workforce learning. Networks such as the Irish Medtech Skillnet provide training in Regulatory Affairs (RA) and quality assurance. Examples of such training programmes developed and offered by the Irish Medtech Skillnet include:

- ✓ **Masters in Medical Technology RA**, a programme, developed specifically to enable regulatory affairs personnel in Medtech to understand the global regulatory landscape, and develop skills to address and prepare for the ever-changing environment of regulatory affairs.
- ✓ **Master of Science in End-to-End Sterility Assurance**, the programme aims to develop an in-depth knowledge and understanding of sterility assurance methodologies for medical technologies in a range of contexts.

The Irish Medtech Skillnet will work with training providers both nationally and internationally to ensure that as the regulations change the network continues to meet the needs of the Medtech sector. This is done through a wide range of training programmes, including but not limited to:

- **Biological Evaluation of Medical Devices,**
- **Certified Quality Engineer American Society of Qualification**
- **Clinical Evaluation for Medical Devices Training**
- **Comprehensive EU Medical Device Regulation (EU MDR 2017/745) Practitioner**
- **Fundamentals in RA for Medtech Industry.**

2. IDA Ireland

IDA Ireland actively promotes Ireland as an attractive location for Medtech companies highlighting the country's business-friendly environment, skilled workforce, and strong infrastructurel. IDA Ireland supports medtech companies via grants and funding assistance for training and upskilling programmes.

3. Enterprise Ireland

Enterprise Ireland supports businesses in enhancing their innovation and skills development. They offer grants and funding for training programmes. An example of this is The Agile Innovation Fund that is used by companies to upskill their staff in regulatory affairs to ensure compliance with international standards.

4. HEA-Funded Programmes and Initiatives

The HEA funds a variety of programmes aimed at enhancing skills that can be leveraged by the sector.

The Springboard+ Initiative offers free and subsidised courses in higher education institutions in areas of high demand, including regulatory affairs and quality assurance. An example of this is the Bachelors in Science in Quality and Regulatory affairs, an example of many Springboard+ courses related to compliance, regulatory affairs, and quality management.

- ✓ **The Human Capital Initiative (HCI)** aims to increase capacity in higher education to meet priority skill needs. It includes measures like conversion courses and skills-based programmes. An example of this is the Higher Diploma in Medical Technology for Regulatory Affairs Professional. All companies can partner with institutions that have received HCI funding to develop tailored training programmes for regulatory affairs and quality assurance.

5. Collaboration with Education Institutions

Partnering with universities and technical institutes can provide access to specialised training programmes and certifications. For example, the National Institute for Bioprocessing Research and Training (NIBRT) offers training programmes tailored for the biopharmaceutical and Medtech industries.

6. Industry Associations and Professional Bodies

Industry associations often provide training, resources, and networking opportunities for e.g., Irish Medtech offers Industry Forums including the Quality and Regulatory Forum and the Sterility Assurance forum, offering member companies networking opportunities, information sessions and workshops on regulatory updates.

10 Future Skills Needs: Sustainability

Key Trends Shaping Sustainability

Sustainability, driven by heightened environmental awareness and regulation is becoming a critical function within medtech, as organisations shift towards green ways of working. With time, the impacts of Sustainability will be felt across the entire organisation.

The Sustainability drive

The EU has outlined in the European Green Deal its 2050 ambition to be a modern, resource-efficient economy , with sustainable processes, maximum levels of circularity and recycling, and climate neutrality.[68] All industries will need to adjust accordingly, and medtech is no exception. Both products and processes will need to adapt to new sustainability requirements.

The role of Sustainability is an evolving area with interdisciplinary skills needs increasingly driven by regulation, growing societal awareness, and the imperative for innovation in RD&I. Experts we spoke to highlighted that ESG (Environmental, Social, and Governance) considerations are in an early stage of development within the medtech industry. However, they view Sustainability as a function that will eventually permeate all levels of the medtech organisation, similar to Quality or Regulatory Affairs, and foresee it forming its own department with cross-functional reach. As one of Ireland's foremost manufacturing industries, there is also a unique opportunity for the Irish medtech sector to drive ESG best practices, become ambassadors for change, and champion new ways of working. This leadership could also become a key differentiator as governments, companies, and customers "go green" and increasing weight ethical considerations in their consumption.

Our experts generally focused on environmental concerns such as material and energy use, which accordingly are the focus of this chapter. Responding to the newly introduced need to report emissions throughout the supply chain is an example of a particularly pressing concern. However, social considerations such as working conditions, human rights, and DEI (diversity, equity and inclusion) also featured in our discussions as areas which need clear understanding and will generate skill needs. Governance considerations, particularly around ensuring ethical supply chains, will also rise in importance.

The evolution of the green economy in medtech is dependent on a variety of factors. Over the next few pages, we detail key trends from a Sustainability perspective, and detail how these can be expected to generate new skills needs within the sector.

The product lifecycle

Sustainability, driven by the trends of corporate ESG, the need for sustainable supply chains, and circularity, will impact each step of the product lifecycle.

1. **RD&I:** RD&I will increasingly need to incorporate sustainable design into products, with consideration given to product end-of-life and approaches to sustainable packaging.
2. **Manufacturing and Packaging:** New energy sources, "green" manufacturing processes, new product types and new packaging needs will drive extensive skills training across this function.
3. **Regulation:** CSRD auditing and reporting as well as compliance with new regulations and new circular products will generate new skills needs within the Regulatory Affairs function.
4. **Commercialisation:** Customers will increasingly be reporting Scope 3 emissions, requiring additional information at the tendering process, requiring commercial to upskill in sustainable principles.
5. **Sourcing, logistics, and transport:** Supply chain, operations, and procurement will need to be equipped to assess suppliers through a sustainability lens.
6. **End-of-life:** All functions, spanning RD&I to commercialisation will need to upskill in circular product principles and take back schemes.

Key Trends Shaping Sustainability

The CSRD imposes new requirements to assess and report on supply chain emissions. This, coupled with global firms assessing the stability of their energy and supply chains, will create future skills needs for medtech.

Corporate ESG

How this trend will shape Sustainability:

The EU's new Corporate Sustainability Reporting Directive (CSRD) adopted in July 2023 will enforce data collection and reporting on 12 different standards, which will apply to all large companies and SMEs in manufacturing. The EU expects 50,000 companies to be bound by the standards, more than a threefold increase on the current 11,700.[69] In addition to top-down legislation, increasing social awareness of ESG among customers, the workforce, and businesses is driving a bottom-up desire for sustainable operations. Increasing energy prices and instability also create a pressing need for energy efficient technology and renewable power.

Who will be most affected:

All of medtech will be in some way affected by the sustainability drive; whether by recycling needs, changes in energy use, or in their day-to-day tasks. Manufacturing, Supply Chain / Procurement, and RD&I will be heavily impacted. Environment, Health and Safety (EHS) will play a key role in implementing some initiatives, while HR will likely have responsibility for overseeing "green" training and conveying to new hires the company's values, particularly in Social and Governance matters.

What skills needs will emerge:

Skills needs will be function dependent. Workforce awareness training will be needed across organisations, while senior management and Regulatory Affairs will need to understand how to implement, prepare for audit, and report on ESG. RD&I will see key skills needs in redesigning devices, utilising new materials, and in circularity. Manufacturing and operations skills needs will centre around green manufacturing process improvement and packaging reassessment, often drawing on lean principles. Supply Chain personnel will require new skills around understanding alternative fuel types, transport options, and scoping of emissions.

Supply chain shifts

How this trend will shape Sustainability:

A key aspect of the Corporate Sustainability Reporting Directive (CSRD) is that it mandates companies to report emission reduction targets, focusing on Scope 3 emissions across their value chain to meet global warming targets set by the Paris Agreement. Smaller companies who may be used to less stringent timelines will feel the effects as larger players request information to allow them to report for CSRD and make informed decisions. Nearshoring to reduce transport emissions may also be a future consideration as companies reassess their supply chains proximity to the US and European markets. Finally, ethical considerations are increasingly a factor by both general consumers and industrial / government purchasing.

Who will be most affected:

Supply chain and Procurement will be where these requirements are first felt, as these functions are best placed to investigate supplier emissions and ethical / governance standards.

What skills needs will emerge:

Beyond Engineer to Order (ETO) processes, sustainability initiatives encompass sustainable procurement to optimise sourcing and reduce transportation impacts. Skills training will be required around waste, water and energy management, operational changes to minimise waste generation, maximise recycling, and promote circularity. Design, procurement, and operational practices will all be affected. Training to assess Scope 1, 2, and 3 emissions, supplier governance, understand carbon and pollution measurements, and undertake ESG and CSRD auditing will be required. Finally, the necessary accounting and supply chain activities will require information related to sustainability. We also anticipate this shift will drive demand for skills training in data analytics and handling, with an ESG focus.

Key Trends Shaping Sustainability

Driven by sterility and efficiency concerns, the medtech industry has historically produced a large volume of single use items. Possessing skills in circularity principles will grow in importance as we shift towards re-usable or re-manufactured devices.

"In our organisation, ESG leadership distributes work downwards, so someone in each division is responsible for implementation. Currently, supply chain are altering our supplier criteria and trialling transport only using sustainable fuels."

Adjacent Sector Sustainability Expert

"We shouldn't think about this as new roles. We should take the ESG lens and place it over existing roles."

Senior Medtech Expert

"The biggest challenge here is the end-to-end scope 3 emissions.....We don't have clarity how to assess or report on these yet."

Medtech Supply Chain Expert

Circularity

How this trend will shape Sustainability:

Circular economy principles are gaining ground in medtech and healthcare more broadly. This shift, aligned with the EU's Green Deal, reimagines how medical devices are made and used, aiming to minimise waste and environmental impact. Currently, many single use devices and implants are disposed of through incineration, resulting in hazardous greenhouse gas emissions and a lack of environmental sustainability. Re-usability of medical devices is a growing focus around the world, although costs, sterilisation difficulties, and the regulation related to remanufacturing remain as challenges.

Who will be most affected:

Our industry engagement highlighted the RD&I function in particular must prepare for circularity in medtech. Manufacturing, Operations, and EHS will also be key functions in implementing sustainable processes on and off the production line. Regulatory Affairs and Quality will also be impacted.

What skills needs will emerge:

Regulatory Affairs and Quality will need new skills around the regulation of end-of-life disposal, whether around recycling, remanufacturing, or sterilisation. Manufacturing will need skills training to implement device recycling, remanufacturing, and novel packaging materials and methods, while the RD&I team will need to be skilled in thinking sustainably, designing for efficient use, and end-of-life considerations.

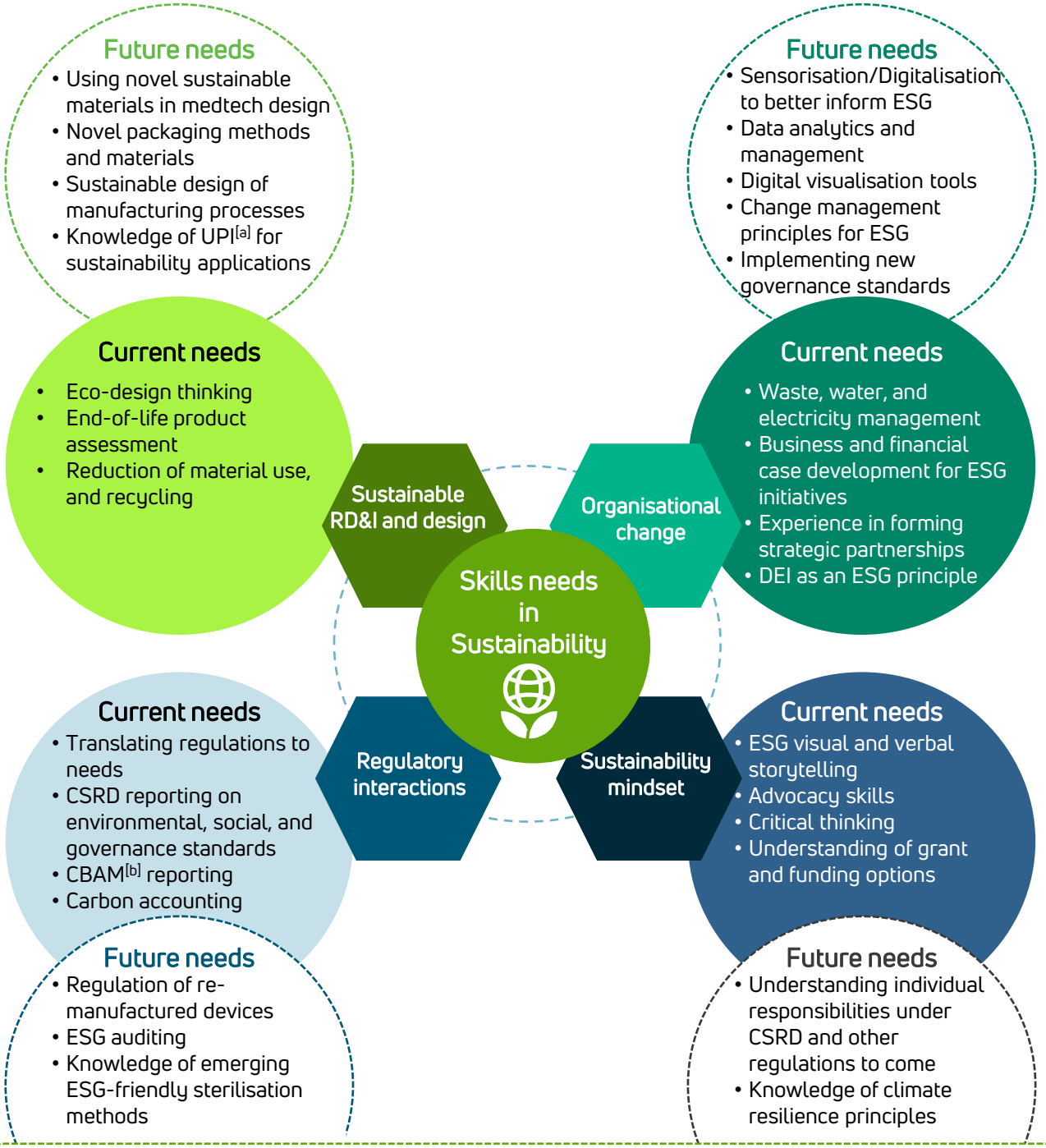
Key skills challenges identified by industry across Sustainability

- Low organisational awareness of ESG
- Difficulty knowing the first steps
- Lack of resources to dedicate to ESG

Current and Future Sustainability Skills

Sustainability skills needs encompass the entirety of the product lifecycle, from design and regulation to manufacturing, transport, and end disposal. There is also a crucial need to enhance the level of ESG knowledge in the medtech industry more broadly.

(The below skills needs are those prioritised by our industry engagement. Please contact the Irish Medtech Skillnet for additional skills identified.)



Sustainable procurement refers to the integration of corporate ESG principles into procurement processes and decision making. It is itself a skill group which stretches across Regulatory interactions, Organisational change, and the Sustainability mindset. Key training needs to develop skills in Sustainable procurement include assessment of Scope 3 supplier emissions, supplier negotiation, understanding of CSRD, and assessment of suppliers based on Environmental, Social, and Governance measures such as ethical supply chain operations.

Notes: **[a]** UPI = Unique Product Identifiers **[b]** CBAM = Carbon Border Adjustment Mechanism

Current and Future Sustainability Skills

Skills needs emerge from the development of new products and processes, the implementation of greener ways of working and the need to respond to new Sustainability related regulation.

Macro-skill: RD&I and Design

A wealth of opportunities exist to re-imagine product lines and processes in a sustainable fashion. Our industry engagement noted that RD&I is integral to the circularity agenda. Skills training should focus on design thinking, circularity, lifecycle and disposal assessment, and in novel ways to reduce, reuse, or recycle. There is a natural synergy with Six Sigma and Lean thinking methodologies, providing extensive scope to utilise existing skills training in this endeavour. As technology develops, future skills will emerge around novel material use in design, sustainable packaging methods and materials, redesign of manufacturing processes for efficiency, and medtech remanufacturing.

Macro-skill: Regulatory interactions

Irish medtech leaders are keenly aware of the upcoming requirements of the CSRD and other legislation. However, current skills needs have emerged around translating these into concrete actions and ensuring companies are ready for auditing and inspections. Carbon accounting is another key skills need, as is assessing scope 3 emissions to conform to CSRD requirements and engaging in constructive negotiation with suppliers to drive sustainability. In additional to environmental disclosures around pollution and circularity, the CSRD will also mandate reporting on social factors (the ethical treatment of the company and its suppliers' workforces) and governance ones (around appropriate business conduct). Supply chain and Regulatory Affairs will be among the functions most in need of such skills training. Legislation will continue to evolve, and future skills training will follow suit. The regulation of remanufacturing, ESG auditing (as requirements are phased in), and regulatory knowledge of new sterilisation methods are all expected to present as future skills needs.

Macro-skill: Organisational change

There is a clear need to train sustainability champions across medtech functions, ranging from manufacturing professionals who will be required to drive adoption of sustainable manufacturing methodologies, to finance professionals, who will be required to support funding plans which enable the climate transition, and potential CSRD reporting itself. Skills needs include business case development, return on investment calculation, project management, and, depending on function, the ability to manage water, waste and electricity use. These core organisational change skills will drive the ESG journey. New products and processes introduced by RD&I or Regulatory Affairs functions will need the full support of other functions to be implemented, and extensive skills training in the ESG elements of change management and new product introduction will be required as a result. Our focus groups also noted that as Ireland moves towards advanced manufacturing, Digitalisation presents an opportunity for data capture, storage, and analysis, to further inform the ESG agenda. Skills needs will follow accordingly, requiring data handling, analytics, and visualisation skills.

> "In the short-term Sustainability is about moving the plan to carbon neutral. That means less waste, green energy use, and smarter ways of working. Skills around product re-design, non-disposable medtech manufacturing will inevitably be needed once this initial process is completed."
>
> **Senior Medtech Expert**

Current and Future Sustainability Skills

Our industry engagement highlighted that skills training is required to incubate the sustainability mindset across the medtech sector. Sustainable procurement is another key area with acute skills needs.

Macro-skill: Sustainability mindset

In addition to targeted upskilling for Sustainability champions, our focus groups highlighted the need for organisational-wide training in adopting an ESG mindset. This should be short form introductory training and will ensure new ESG initiatives meet with success. As this progresses, skills training can shift and become more advanced with time, helping each member of the workforce to understand how their role can greater empower ESG. For individuals with specific responsibilities, training in areas such as undertaking an ESG focused gap analysis, and understanding of grant and funding options will be vital. As new regulations come into play, future skills training should adapt to train the workforce in these topics.

"Other than capital expenditure, the next level of sustainability involves organisational culture. How can I personally help employees make more sustainable choices within the business? And for this, we don't need new materials or investment; we need people to adjust their mindset. I believe perhaps 1 in 30 people will be sustainability champions, capable of driving transformation within the business."

Senior Medtech Expert

Macro-skill: Sustainable procurement

The importance of sustainable procurement skills is increasing in line with the growing awareness of ESG principles and incoming regulations such as CSRD. Financial, supply chain, and procurement teams will need training to evaluate suppliers and report on procurement practices. This includes assessing and determining the suitability of suppliers on environmental aspects (emissions, pollution, resource use), social aspects (workforce, consumer, end-user impacts), and governance aspects (ethical business conduct, legal compliance).

"We carried out our first social audit last year, encompassing quality checks, environmental impacts, and assessment of our workforce wellbeing. This was brought on by our larger customers in medtech demanding this from all suppliers."

Medtech HR Expert

"Training is required to understand all the sustainability implications across each element of the supply chain. This will also mean people will really understand what their own impact is."

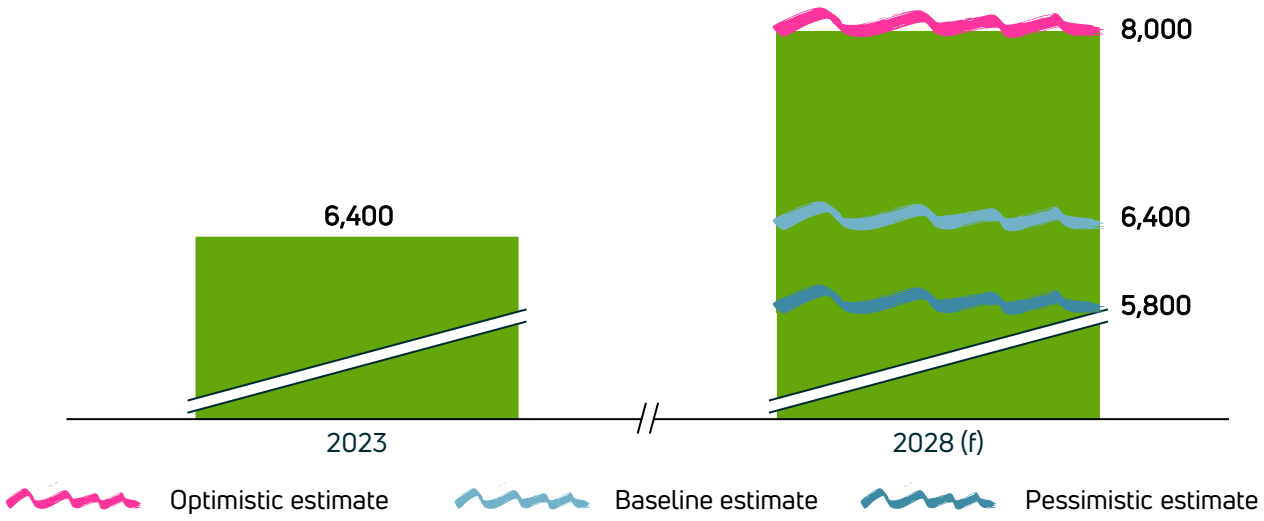
Medtech HR Expert

Sustainability Growth & Training Preferences

Sustainability-impacted functions may see up to 1,600 new hires by 2028. Two distinct skills needs exist; support in developing a general "sustainability mindset" for the majority of the workforce, and highly specific skills development for sustainability leaders.

Forecast growth in functions impacted by Sustainability pillar [a]

Growth forecast from expected hiring activity by individuals employed in relevant functions, 2023-2028, optimistic, baseline, and pessimistic cases, data gathered as part of our survey of >400 employees in Irish medtech industry



Sustainability course preferences

Training approach	All functions	Sustainability leaders
Online or In-person	All functions are anticipated to receive some ESG training, likely delivered using the same methodology as the company's onboarding or annual training.	Our industry engagement indicated a preference for blended learning for deeper, more specific ESG training.
Short or Long	For most individuals, ESG training will consist of a few hours.	A limited number will receive highly specialised training in longer courses. Modularity would be optimal.
General or Targeted	Most training will be broad and "ESG mindset" orientated.	Some individuals will be highly specialised, and will have responsibility for ESG implementation, auditing, etc.

Sustainability is a broad macro-skill requirement across the sector, which is still developing. There is an opportunity to raise awareness at all levels across functions, as well as providing targeted upskilling for those sustainability leaders who will drive change.

Notes: **[a]** Supply Chain, EHS, and related functions were deemed to be Sustainability relevant functions. Predictions of growth were derived from our industry survey. Growth rate predictions from companies with less than 50 employees were discounted due to these companies having a different growth trajectory than the industry in general.

Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

Key Learnings for Sustainability

Our findings highlight the need for organisational-wide education, specific Sustainability skill sets, and digital training as a method to fully empower this function.

Sustainability will grow in importance as a function in the years to come, which will naturally generate skills needs in implementing, managing, and reporting on sustainability efforts. Our industry engagement highlighted that specific skills around sustainable RD&I, organisational change, regulatory interactions including CSRD reporting, and incubating the sustainability mindset were all required. A digitally proficient workforce will also be needed to drive the ESG transformation across medtech. To best support the growth of this sustainability mindset, both organisation wide cross-functional training in broad sustainability concepts, and targeted detailed training for sustainability experts will be needed.

What we learned	Recommendations
Sustainability is an evolving function necessitating two levels of skills 	• Interviewees and workshop attendees felt Sustainability is in an early stage with poorly defined skill sets. • The understanding of 'Why ESG' and of CSRD is not widespread. • Many experts noted it is difficult to know where to begin with ESG efforts, and the medtech industry has yet to define an ESG function. Sustainability efforts are normally adopted by EHS, site managers, or willing volunteer functions. • There are key skill sets that are required. These include Sustainable Procurement, CSRD Reporting, and assistance with preparing for CSRD audits.	Industry experts recommended short, high-level organisational-wide training. This would encompass no more than a few hours per year for each employee. A smaller number of highly trained experts will be needed to actually implement sustainability changes. These would encompass project managers, able to make the case for sustainability and implement it. It would also include sustainability-trained accountants, supply chain experts, and regulatory professionals to address each of the CSRD requirements.
Digitalisation is key for an informed Sustainability function 	• Sustainability requires a detailed understanding of water, electricity, heat, and other resource expenditures, which can be challenging to ascertain without sensors and other data-collecting devices. • Once data is generated, it needs to be analysed and visualised to derive actionable insights. • Digitalisation is a prerequisite for many ESG efforts. Enhancing digital skills across the organisation will naturally benefit sustainability initiatives.	Various digital skills relevant to other aspects of the industry are also crucial in sustainability. While these skills may not specifically focus on sustainability, they encompass essential competencies such as data entry, storage, analysis, and visualisation.

Key Learnings for Sustainability

There is a range of Sustainability resources available for the medtech industry in Ireland focused on taking the first steps in the sustainability journey, responding to the CSRD, and training in environmental management.

How industry can engage to support Sustainability talent needs

As the sustainability focus increases across the world, so too does the need for the skills and talent that will be required to implement its requirements. Within Europe, Ireland and other member states have until mid-2024 to transpose the CSRD, with a view to mandatory requirements commencing for financial years on or after this. The medtech industry in Ireland can access support for talent and skills development for sustainability by engaging with government programmes and initiatives including:

1. Skillnet Ireland Programmes

The Irish Medtech Skillnet participates in targeted training programmes that include sustainability practices relevant to the Medtech sector. These include:

- **The First Steps to Sustainability,** a series of informational workshops that bring together sustainability experts and manufacturing industry case studies to explore and outline how manufacturers can begin their journey to becoming more sustainable and resilient in their supply chains.
- **Building a Sustainability Mindset**, which provides a framework and educational experience approach that will empower industry team members to form sustainability teams that can begin to enact real change, while simultaneously becoming equipped to create a foundational culture of sustainability that is embedded across the organisation and its supply chain.
- **Sustainability Skillnet** (Enterprise, Finance and HRM) and **The Green Tech Skillnet** are specific initiatives under Skillnet Ireland that provide training and development programmes aimed at enhancing sustainability skills across various sectors.
- Furthermore, to implement CSRD within industry the IMS will engage with industry to ensure that they are supported in skills training in sustainability and environmental management, data management and reporting, regulatory and compliance knowledge, and financial acumen, among the other areas in this report.

2. Enterprise Ireland & IDA Ireland

Provides funding and support for companies, including those in the medtech sector, to develop sustainability skills and practices. They offer various grants and advisory services.

3. Irish Medtech

As part of Ibec, Irish Medtech offers resources, training, and networking opportunities focused on sustainability and regulatory compliance.

4. Educational Institutions and Partnerships

Many Irish universities offer courses and programmes in sustainability, environmental science, and corporate responsibility. Furthermore, the Springboard+ program provides free or subsidised courses in areas of skills shortages, including sustainability and environmental management.

By leveraging the above resources, the medtech sector in Ireland can ensure it has the necessary skills and talent to meet the evolving sustainability requirements mandated by the CSRD and other regulatory frameworks.

11

Future Skills Needs: Human Resources

Key Trends Shaping HR

Human Resources is shifting to become a digitally-enabled function, which links across all other functions in medtech. The shift to remote and hybrid working, as well as deployment of novel training technologies are creating key skills needs for HR professionals.

The strategic role of HR

HR is a strategic function within medtech, interacting with and guiding all other parts of the business to ensure commercial success through activities such as talent acquisition, provision of training, employee relations, culture development, organisational change and acting as senior business advisors to management teams. Dispersed workforces with high levels of diversity are increasing the complexity of the HR role, generating a need for new skills. Similarly, the HR function is influenced by broader technological innovation, requiring new skills to leverage digital tools, such as data analytics and visualisation, digital communication tools and online marketing skills.

Extended reality training methods and remote/hybrid working were highlighted by our research and industry engagement as key macro-trends which will impact the skills agenda in HR.

Extended reality training tools

How this trend will shape HR:

Extended reality (XR) is a novel tool in training and workforce development which offers a "hands-on" experience, without impacting production schedules. As the need for upskilling in advanced manufacturing processes arises, HR will likely be called upon to leverage tools such as XR to support upskilling across the organisation. An example of a medtech company in Ireland leveraging XR, Freudenberg Medical, is discussed on page 62.

Who will be most affected:

While all functions of the business will come to use XR training, the HR function will be strongly impacted, as they will likely be responsible for interacting with providers and supporting deployment.

What skills needs will emerge:

Implementing XR training will require skills in understanding the applications and use cases of the technology, as well as transversal skills such as creativity, to assist in maximising its value.

Remote and hybrid working

How this trend will shape HR:

Remote and hybrid working, now viewed as a necessity by many office-based employees, is shaping the future skills needs in HR, as employees communicate in a "digital first" manner using tools such as Microsoft Teams or Zoom. Similarly, core roles of the HR function such as recruitment will increasingly require a digital first approach.

Who will be most affected:

As working practices shift digitally, all individuals within the HR function will be impacted. It is worth noting that the manufacturing function requires in-person attendance, suggesting HR will need to balance the needs of digital versus in-person employees, likely requiring different skills needs.

What skills needs will emerge:

Key skills noted in our industry engagement included digital communication and collaboration skills, as well as online marketing and coaching skills to fully engage the online workforce.

> "The way we communicate with employees will change; people will want instant updates. We need to develop skills to operate within this digital world."
>
> Medtech HR expert

Other Trends Shaping HR

The growing level of diversity in the workforce, increase in the number of apprenticeships in medtech and overall digitalisation of the function will drive future skills needs in HR.

Diversity, Equity, Inclusion and Belonging

Diversity, Equity and Inclusion (DEI) initiatives have become an increasingly critical part of an organisation's strategy, both to retain its current workforce and to attract future talent. DEI is focused on recognising and cherishing the differences which exist amongst employees to create an environment where individuals can be themselves. The additional concept of Belonging (DEI&B) is also gaining prominence, which centres around the employee experience of feeling accepted within their workplace. Adopting a DEI&B approach has clear benefits in creating a more engaged and involved workforce where innovation thrives.

The HR function is a key enabler of the organisation's work to implement DEI&B. On a practical level, this could be supported through the creation of employee training to increase DEI&B understanding and broader cultural awareness initiatives at all levels of the organisation, as well as the development of associated policies and procedures. HR's role in this area is critically important; our industry focus groups identified knowledge of DEI&B principles as a current training need, with future needs in specific segments of the DEI&B initiative, such as building awareness of gender diversity as an example. HR professionals will additionally need to be equipped with the skills to drive this initiative, such as communication skills, cultural awareness, emotional intelligence and facilitation skills.

Technical Education

Ireland is moving towards recognising the value of a technical education. Technological Universities began to receive designations in 2019, with €90m dedicated to transforming these centres over 2020-2022.[70] The Manufacturing Engineering Apprenticeship, developed by the Irish Medtech Association alongside industry partners and the Atlantic Technological University Galway is a leading example of the potential for apprenticeships in the sector.[71] Furthermore, the launch of "Generation Apprenticeship" and the proposed introduction of a National Apprenticeship Office further indicates Ireland's commitment to this underutilised model of education.[72] This new source of talent for the medtech sector will create skills needs for the HR professional in workforce management and organisational design, as they aim to support these individuals successfully integrate to the business.

Digitalisation of the function

The function is becoming increasingly digitised, creating new skills needs for HR professionals. Human resources information systems (HRIS) are software solutions which maintain, manage and process employee information, HR policies and organisational procedures with the aim of standardising the HR workflow and increasing productivity (e.g. HRLocker).

Whilst HRIS tools are viewed as essential, our research noted multiple different versions of these tools being available on the market, each creating different skills needs. Furthermore, HR professionals indicated specific training on how best to leverage these tools would be valuable.

As the function becomes increasingly responsible for curating both internal data (employee related) and external data (compensation, benefit benchmarking etc.), skills will also be needed in data analysis and visualisation. Our focus group highlighted specific future skills needs in leveraging data visualisation tools such as Tableau and Power BI to increase HR's impact.

Finally, the function is aware of the coming AI transformation, but has key skills needs in understanding the principles of AI, and how it could be leveraged to support HR. Our research suggests that within the HR function, AI will be leveraged to automate routine tasks, such as workforce management and communications, alongside some elements of recruitment and exit management. Transversal skills needs will emerge in HR as a result, such as increased strategic decision-making skills, and creativity in the application of AI.

> "I expect digitalisation will affect everything in the coming years, with the implementation of new HR information systems. All departments will undergo a huge digitalisation transformation."
>
> **Medtech HR Expert**

Other Trends Shaping HR

Broader changes in people strategies will drive additional skills needs in HR professionals, while new, human centric approaches to manufacturing will further position HR as a key strategic influencer within the organisation.

Human Centric Manufacturing

Human Centric Manufacturing (HCM) is a component of the advanced manufacturing journey which seeks to align the organisation's enterprise strategy, leadership values and manufacturing technology to enable a fully data-driven, people focused business. It centres on the creation of manufacturing environments which prioritise the wellbeing and contribution of workers, alongside that of advanced digital technologies. HR will have a key role to play in implementing a HCM approach within the workplace, creating both technical and transversal skills needs such as an understanding of manufacturing processes, problem solving, critical thinking and influencing.

Changing people strategies

The future of work revolves around skills, not specific jobs roles. There's a shift towards a skill-centric approach for attracting and retaining talent, whereby candidates are evaluated for roles based on the skills they possess, rather than their work history. Medtech companies are now seeking employees from other fields with relevant skill sets to support their current organisation e.g. IT skills. This approach may require HR professionals to adapt their approach to recruiting, creating new skills needs.

As medical technology companies realign towards a digital operating model, leaders in workforce management must re-evaluate the skill sets required by their organisations. A significant challenge arises as employers in the life sciences sector are no longer solely in competition with each other to acquire critical skills needed for future digitalisation.

They now find themselves casting their recruitment nets into the same talent pool as industry heavyweights such as Google, Microsoft, IBM, and other technology giants renowned for their robust corporate brands and innovation prowess.[73] We anticipate that as the need for digital talent increases, medtech will increasingly find itself competing with other sectors, including tech to recruit employees. This introduces a pressing need to make the case for a career in medtech to potential employees, creating skills needs in HR professionals such as clear communication, visual and verbal storytelling and commercial acumen.

How are life sciences companies evolving their people strategies today? [74]

77% say that their organisations are more focused on talent experience than before

70% are investing in talent analytics

67% say reskilling helps to mitigate the scarcity challenge

35% say that they are providing flexible arrangements to address talent scarcity

33% say talent scarcity is a major pain point

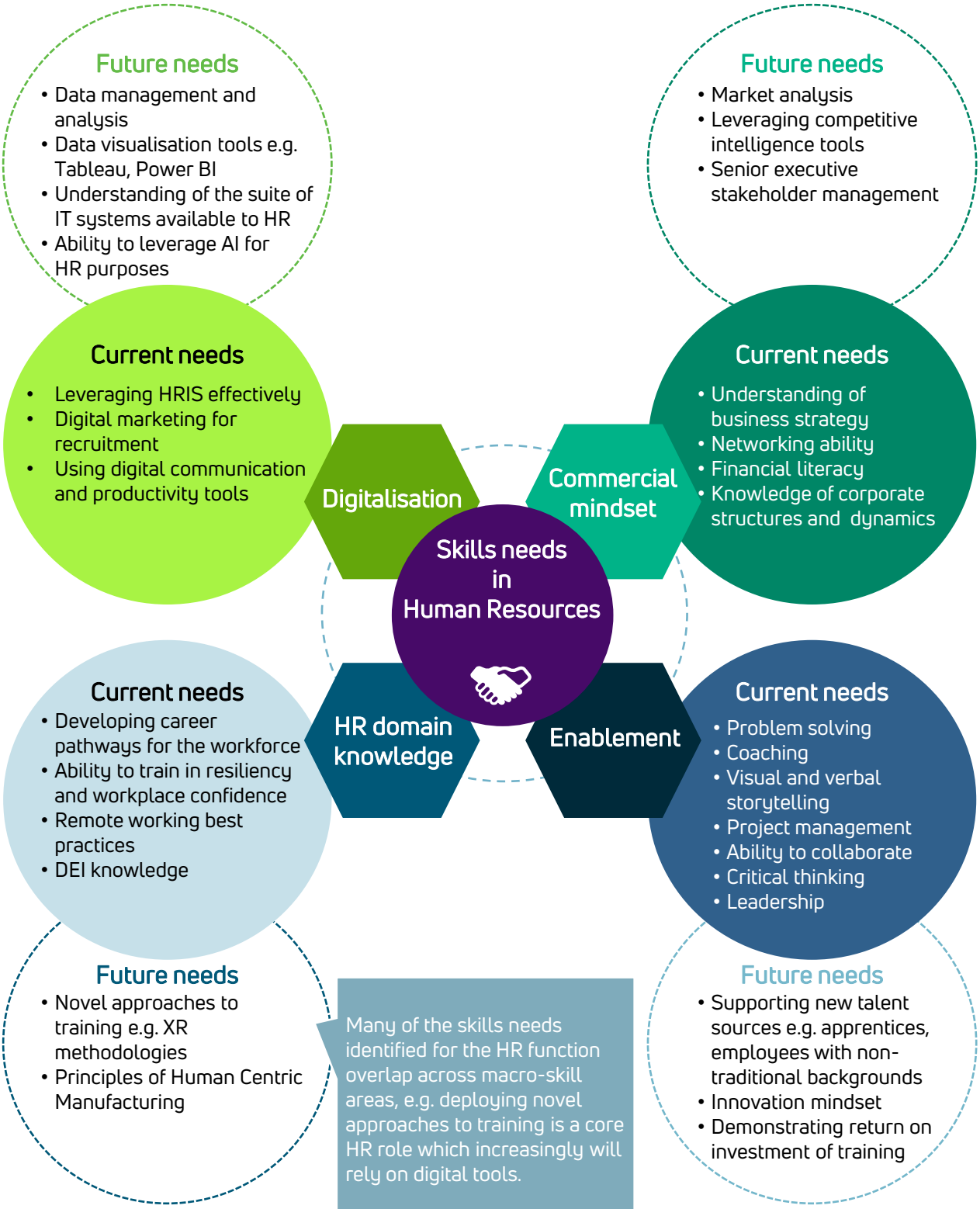
Key skills challenges identified by industry across Human Resources

- Motivating employees
- Scarcity of digitally skilled individuals
- Difficulty in quantifying Return on Investment of training

Current and Future HR skills

HR skills needs will be driven by digitalisation of the sector and evolving ways of working, generating a need for technical and transversal skills, as well as core HR expertise. As it further develops as a strategic function, HR will need to enhance its commercial mindset.

(The below skills needs are those prioritised by our industry engagement. Please contact the Irish Medtech Skillnet for additional skills identified.)



Current and Future HR Skills

HR skills needs are being driven by the shift towards a digital work environment and subsequent evolution of core HR processes, alongside the need for the function to increase its strategic influence within medtech.

Macro-skill: Digitalisation knowledge

HR, like other functions in medtech, will also face significant skills needs due to digitalisation of the sector. These will be less related to specific smart product knowledge, and instead focused on leveraging digital tools to enable HR to operate effectively. Current HR skills needs exist in HRIS; there are a number of these systems available on the market, with skills needed in identifying the correct system and maximising its use. Similarly, digital communication tools (e.g. Slack, Microsoft Teams) and digital productivity tools (e.g. Microsoft Office) are critically important in the hybrid and remote working environment, with an opportunity to upskill the HR function on best practices to maximise productivity. HR are increasingly identifying skills needs in digital marketing, to ensure the right candidates are being attracted to the company.

It is expected that the HR function will need to collate, analyse and visualise datasets, both related to internal employee data (i.e. talent analytics) and external market insights, creating future skills needs in data analysis and visualisation. AI will assist the HR function with automating some of its workflows, but there is a need to upskill individuals on what these tools can offer the function. Our experts also highlighted the future need for individuals with IT skill sets within the function, who can interface across different digital tools to supercharge HR's output as digitalisation progresses.

"It would be great if our HR people had more data handling skills. We could begin applying this to internal data and better understand how we operate internally."

Medtech HR Expert

Macro-skill: Enablement and support

Transversal skills are critically important to the HR function, reflecting their need to engage with the workforce across the organisation and at all levels. Problem solving and coaching skills are needed so HR can facilitate solution focused-discussions. Leadership, visual and verbal storytelling and critical thinking skills are current needs which senior professionals within HR require to further influence across the organisation, while project management methodologies are needed across all levels of HR.

In the future, in line with the increasing diversify of the workforce, and a shift towards a skills-centric approach to recruitment, HR professionals will have future needs in supporting new talent sources as they enter medtech from non-traditional backgrounds (e.g. tech), or through new training programmes such as apprenticeships. HR will also need skills in demonstrating a return on investment from their training initiatives. Instilling an innovation mindset through upskilling in the principles of innovation was also highlighted as a key method of increasing the impact of HR across medtech, and also keeping the function exciting from a recruitment perspective.

" Skills around collaboration, interactivity, and supporting others in new initiatives are key, and are a big part of why Ireland has been so successful in medtech. Every business is ultimately a people business, even medtech."

Senior Medtech Expert

Current and Future HR Skills

HR skills needs are being driven by the shift towards a digital work environment and subsequent evolution of core HR processes, alongside the need for the function to increase its strategic influence within medtech.

Macro-skill: Domain knowledge

As drivers of the people strategy, there is a current skills need to support a remote workforce, including best practices in digital communication. Similarly, the workforce is becoming increasingly diverse, with our industry experts noting a current skills need to equip HR professionals to ensure all elements of the organisation are fair and equitable.

In the future, we anticipate that the HR function will need to leverage novel approaches to training, such as XR technologies. HR will also have a key role in implementing the principles of HCM in the workplace, requiring skills such as an understanding of manufacturing processes, as well as transversal skills such as problem solving and critical thinking.

> "There are essentially two HR skill sets, the outward facing and the inward facing. They don't have the same skill sets or skills needs.
>
> **Medtech HR Expert**

> "A short form version of a HR PMP course to teach basic principles would increase the credibility of HR professionals. The HR professional should be a skilled project manager.
>
> **Medtech HR Expert**

Macro-skill: Commercial mindset

HR is already a strategic influencer within medtech, but our research suggests this could be enhanced through the further development of a commercial mindset. To achieve this, there are current skills needs in understanding business strategy and corporate structures, financial literacy and networking skills.

In the future, the function will increasingly need to analyse the external market, both in terms of compensation and benefits for its employees, but also how the organisation is perceived from a recruitment perspective. This will generate skills needs in conducting market analysis, through both primary and secondary research methods as well as leveraging competitive intelligence tools. Importantly, as the strategic importance of the function grows further, we expect the HR professionals to have future skills needs in managing relationships with senior executive stakeholders across the organisation.

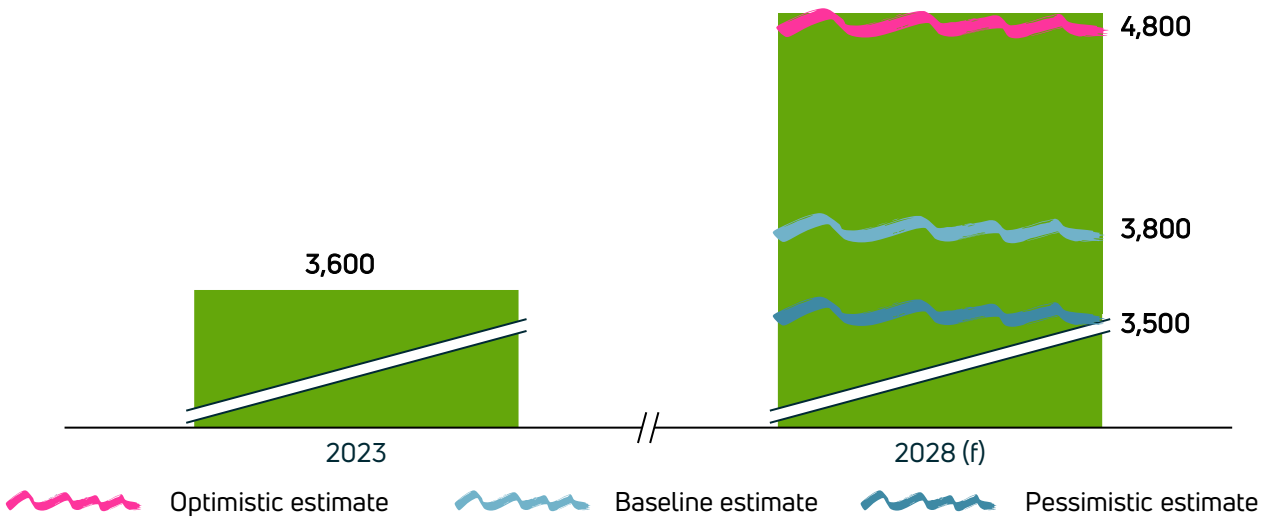
> "Skills that allow HR to begin to face in and to connect with mid-management (e.g. business acumen, corporate understanding) are key. These are the main influencers within an organisation that HR needs to be able to network with."
>
> **Medtech HR Expert**

HR Growth and Training Preferences

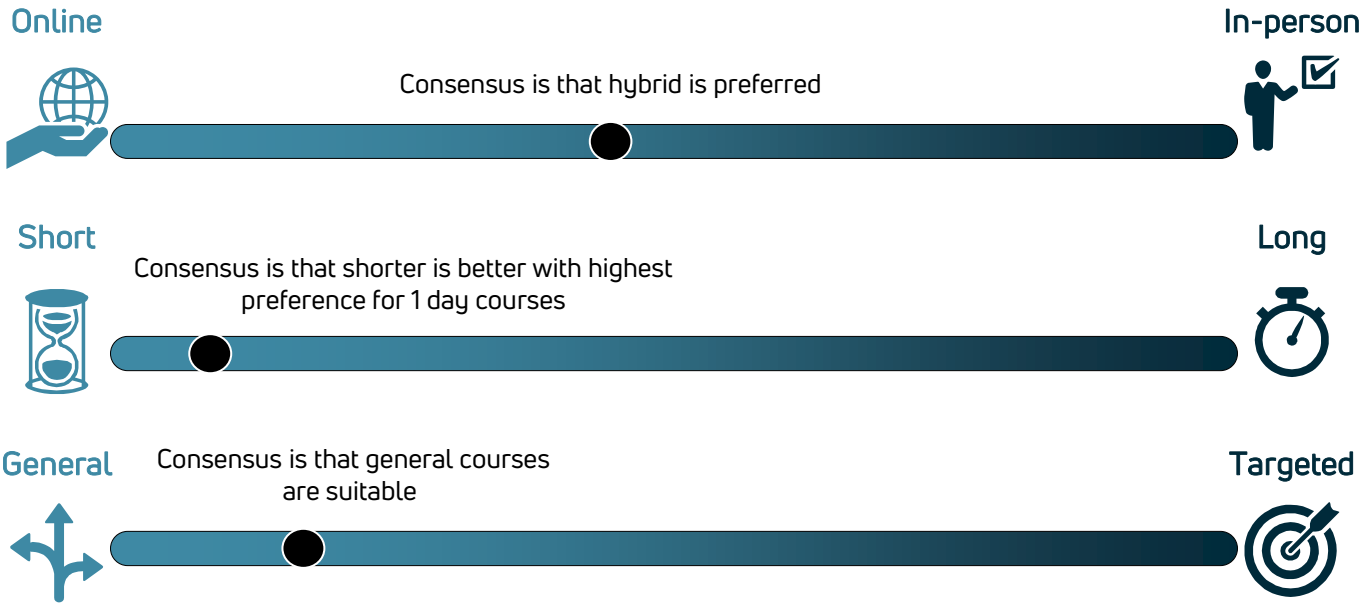
The HR function is expected to grow up to 4,800 employees by 2028, an increase of 1,200 compared to 2023. The function's preferences are for shorter courses delivered via a hybrid online / in-person approach.

Forecast growth in functions related to HR pillar[a]

Growth forecast from expected hiring activity by individuals employed in relevant functions, 2023-2028, optimistic, baseline, and pessimistic cases, data gathered as part of our survey of >400 employees in Irish medtech industry



HR course preferences



Experts noted that broad courses enabling HR to understand the needs of other functions (e.g. introduction to digitalisation, finance) and implement solutions for those needs (project management, stakeholder management) are key skills needs.

Notes: **[a]** HR relevant functions include HR and L&D. Predictions of growth were derived from our industry survey. Growth rate predictions from companies with less than 50 employees were discounted due to these companies having a different growth trajectory than the industry in general.

Source: KPMG and Irish Medtech Skillnet administered survey, September-December 2023.

Key Learnings for HR

Our learnings from this research highlight the increased digital skill sets needed in HR, the need for the function to build awareness of other parts of the business to continue being a strategic influencer, and easy-wins for training the function, by repurposing content from other areas.

Human Resources will continue to play a key role in medtech but will see changes in how it operates as digitalisation progresses. Digital skills training will be a critical future need for HR professionals, along with training in transversal skills such as problem solving and business strategy. Our industry engagement highlighted that there is an opportunity for the function to further grow its strategic role within medtech and assist in delivering organisational-wide change.

What we learned		Recommendations
Digitalisation in HR needs to be addressed	• Digitalisation and Data Analytics are the most urgently required skills by HR professionals. • The role of HR is changing due to digital tools and the availability of "big data", enabling more data informed decision making. • The broader medtech workforce has significant skills needs, which HR must also upskill on.	Courses providing a working knowledge of tools such as Tableau, Power BI, and Excel, can provide a firm grounding in digital skills. The large variety of digital HR tools available can be overwhelming; short seminars on how to leverage these tools and implement digitised work processes within HR would support the needs of the function.
Human Resources needs to continue being a strategic influencer	• HR's remit is across all business functions; courses that assist HR with understanding other function's needs would deliver significant impact. • HR's voice can be amplified by function-agnostic skills sets, such as problem solving, business strategy and development of a commercial mindset.	Some of HR's skill needs could be solved with brief, broad courses on other functional areas of the business, equipping the HR professional with an increased understanding of each function's activities. Problem solving skills needs could be addressed through training of tried and tested methodologies, such as Root Cause Analysis, Corrective and Preventative Actions (CAPA) and the use of the "Five Whys.".
Courses need flexibility and better promotion	• A major theme from our work is the need for courses to be modular and flexible. A topic such as "Finance", "L&D", etc. may not require a full degree, but a short course would enable HR to upskill effectively.	Repurposing content originally aimed at other functions could be an easy win e.g. data analytics training. These will require only minor changes, and the correct marketing, to ensure HR personnel are engaged and the relevance of the material is made clear.

Key Learnings for HR

Human Resources professionals can draw on supports from a variety of government and other institutions, with key skills training available from Skillnet Ireland on managing people, training, mentoring, and enterprise excellence.

How industry can engage to support HR talent needs

Similar to the previously discussed pillars, the medtech industry in Ireland has access to a variety of supports aimed at enhancing HR skills and talent development. These supports come from government agencies, industry associations, educational institutions, and private organisations, with key resources outlined below:

1. IDA Ireland

IDA Ireland offers various supports for businesses in the medtech sector, including grants and funding for training and development programmes.

2. Enterprise Ireland

This agency provides funding and support for small and medium-sized enterprises (SMEs) in the medtech industry, including innovation vouchers.

3. Skillnet Ireland

The Irish Medtech Skillnet is one of the 70 Skillnet networks funded under the Skillnet business networks. The Irish Medtech Skillnet delivers a wider range of training programmes to support HR skills and talent development, these include:

- ✓ **Certificate in Management for the medtech and engineering sector**, developed for employees who aspire to consolidate their existing operational experience and gain a formal management qualification.
- ✓ **Competent Trainer**, to equip Trainers with the skills required to effectively and competently train others.
- ✓ **Continuing Professional Development in Project Management** (L7).
- ✓ **Living Leadership**, for high potential women in the Irish medtech and manufacturing sectors.
- ✓ **Managing People Skills**, designed to assist managers to build on the skills introduced in our Managing People Programme. Participants will gain a greater understanding of their communication style and its impact on those they manage.
- ✓ **MÓR™ Enterprise Excellence Implementation**, a mentor-led business management framework which applies powerful tools, strategies, skills, and guidance to achieve continuous and measurable performance improvement in your organisation, empowering your people to achieve their full potential and ensuring you stay at the forefront of industry.
- ✓ **Professional Mentor Training** (EMCC), an accredited mentor training program which prepares emerging leaders for mentoring roles in the Irish medtech industry.
- ✓ **Global Trade Compliance**, introduces global trade compliance, developed for employees who aspire to consolidate their existing operational experience and gain a formal global trade qualification.

4. Irish Medtech

The Irish Medtech trade association offers networking opportunities and resources specifically designed for the medtech sector, including a quarterly HR Forum. They provide access to workshops, seminars, and development programmes for the sector.

5. Universities and Institutes of Technology

These offer specialised courses, professional diplomas, and degree management programmes.

6. HEA Springboard+

This government initiative offers free and heavily subsidised courses at various educational institutions, including those focused on management development skills.

These supports collectively help the medtech industry in Ireland to develop and retain skilled talent, ensuring that the sector remains competitive and innovative on a global scale.

12

Recommended actions, enablers, and conclusions

Recommendations: Enable Medtech to Thrive

Our industry research, survey, extensive stakeholder engagement, and multiple workshops identified the future skills needs of Ireland's medtech sector, and also uncovered industry-validated methods to address them.

Skills for the future

Our research and stakeholder engagement identified a clear desire across the medtech sector to better understand current and future skills needs, so that the workforce can continue to thrive. Both function-specific and sector-general trends are creating some acute skills needs in the Irish medtech sector which need to be addressed to enable continued growth.

Across functional areas, the shift towards digitalisation is anticipated to create new skills needs relating to advanced manufacturing and data analytics, but also in skills relating to interfacing with technology, assessing data outputs, and understanding how digitalisation will change one's own role.

Transversal skills are another group of cross-functional skills needs which are impacting all roles in medtech. Skills needs around leadership, negotiation, problem solving, and commercialisation remain as relevant and urgently required as ever. Although transversal skills continue to be skills needs for the sector, traditional transversal skills training may need to be adapted for the digitised world.

Communication and leadership, for example, are implemented differently in a "work from home" environment versus than in a manufacturing plant.

Sustainability is another major theme impacting skills needs across medtech. Experts consulted firmly believe sustainability will eventually form its own function, but its impact will be felt far beyond our understanding of the role today. All roles can be expected to see some ESG-related skills needs.

Across skills pillars, experts consulted highlighted the challenging environment for skills training. This included the difficulty in committing to long-term skills development, lack of clarity on what exact skill needs an individual had, and the inability to free up valuable personnel to participate in training. Experts also highlighted pillar-specific difficulties and proposed solutions to address training needs, which are summarised below. These, alongside our comprehensive future skills needs list, create a training roadmap for the sector to ensure the future Irish medtech workforce has the key skills required to continue to thrive and be future-ready.

Summary recommendations – Research, Development and Innovation

Research, Development and Innovation

Insights

RD&I experts conveyed to us that more training is needed around market understanding and routes to commercialisation to enable RD&I.

Senior RD&I leaders noted that a barrier to effective RD&I is in ensuring leaders have the diverse skill set they require; including leading diverse teams, project management, obtaining stakeholder buy-in, and presentation skills.

Our industry experts also noted that different sized companies have different skills needs, with smaller companies requiring an individual with more transversal skills. Across all companies, the demand for smart tech experts is high.

Recommendations

As well as targeted training in future skills needs in areas such as advanced manufacturing, training should also focus on basic biomedical knowledge if not already present, and transversal training for senior roles.

Sustainability is increasingly important in RD&I; industry needs to prepare by upskilling in areas such as sustainable design thinking, novel materials, and in re-usability.

All RD&I experts emphasised the high demand for smart technology skills, which is expected to continue to be a need into the future. Further scaling of the "industrial PhD" model is a potential enabler to assist in attracting and retaining RD&I talent.

Recommendations: Enable Medtech to Thrive

Summary recommendations – Manufacturing and Regulatory Affairs

Manufacturing

Insights

Our industry engagement highlighted a challenge in equipping newly promoted individuals in senior manufacturing roles with the skills necessary for leadership.

Manufacturing experts noted that "production is king", and it is very difficult to free employees or floor space for training. This creates a challenge for skills training, as well as a need for novel solutions.

All experts showed high interest in apprenticeships, and suggested more support for scaling these would help address Ireland's skills needs.

Recommendations

Training for manufacturing professionals must balance practical components whilst ensuring production is not impacted. This could be achieved via a purpose-built centre, virtual reality training, or other solutions. As an example of a novel solution, on page 62 we provide an example of a medtech company in Ireland, Freudenberg Medical, successfully implementing virtual reality training.

The shift towards a fully advanced manufacturing state will create skills needs in digitalisation and automation. Additionally, as the data infrastructure undergoes further development, skills needs will emerge in cybersecurity, data warehousing, AI and data analytics.

Regulatory Affairs

Insights

Experts highlighted the interpretation and application of sometimes ambiguous regulation as a skills need, but noted this generates skills needs in negotiation and leadership.

Due to perceived difficulties in adapting to a highly regulated sector, it can be difficult to attract new talent into Regulatory Affairs and medtech more broadly.

Large volumes of data are being created, and Regulatory Affairs skills needs are emerging around data handling and understanding.

Recommendations

An empowered Regulatory Affairs function could deliver further organisational impact. Project management, leadership and data analytics skills training will enable the function to input and grow in strategic importance across the organisation.

The rise in importance of markets such as India and China are driving the need for skills to navigate these regulatory environment. As other global markets gain importance, similar skills needs will emerge.

The Regulatory Affairs function has high priority skills needs in smart devices, with future training needed in the AI Act, and eventually the European Health Data Space.

Recommendations: Enable Medtech to Thrive

Summary recommendations – Sustainability and Human Resources

Sustainability

Insights

Organisational awareness of ESG remains low in medtech, creating a natural barrier to skills training and change initiation.

Many experts highlighted that even though there is willingness to introduce change, it is difficult to know what the first steps are. There needs to be more skills training to support the ESG champions who will implement changes in their companies.

Sustainability will permeate all functions over time, with the impact to be felt from the manufacturing floor to the boardroom.

Recommendations

To achieve organisational-wide sustainability targets, both now and into the future, two distinct approaches to training are required; short, high-level organisational-wide training for most employees, and highly targeted and technical training for project managers, supply chain experts, and regulatory professionals.

Sustainability initiatives rely on making informed decisions backed by data. As such, digital skills around data gathering, cleaning, storage, analysis and visualisation are crucial, both now and in the future. Digitalisation will empower the Sustainability drive and is key to its success, creating a need for digital skills training with an ESG mindset.

Human Resources

Insights

Ensuring a ready supply of digitally skilled individuals, both for HR and for all other functions, is a challenge and is expected to continue as such.

It is difficult to create the time and space needed for training, an insight echoed by other functions.

Knowing how to calculate the return on investment of training and make the case for skills training is a barrier to skills training.

Recommendations

Digitalisation courses providing a working knowledge of digital tools (e.g. HRIS) would empower HR to be more efficient.

The HR function prefers training courses which are short and flexible. Repurposing content which is aimed at other functions in transversal skills, etc. could be an easy win for medtech organisations.

Succinct, insight driven courses on other functional areas within medtech, as well as training on transversal skills such as problem solving, and commercial acumen would enable HR to further expand its role as a strategic influencer.

Opportunities to Better Enable Upskilling

In addition to identifying the current and future skills needs of the medtech sector in Ireland, this comprehensive research program identified 10 industry-approved enablers to guide the sector towards addressing these needs.

Industry-approved enablers

Proposed stakeholders involved[a]: Irish Medtech Skillnet | Industry | Academia

1 Create business-oriented training courses for SMEs and FDI employees to facilitate accelerated commercialisation.	2 Design bespoke training opportunities for transversal skills development, covering leadership, commercial acumen and problem solving.	3 Design sustainability-centric training programmes encompassing general sustainability principles as well as eco-product design.	4 Develop a suite of tools, e.g. a Return-on-Investment tool to quantify value generated by employee training, a Skills Needs Assessment tool, etc.	5 Leverage emerging digital tools like VR and AI to deliver tailor made training for manufacturing, RD&I and other functions.
6 For key medtech roles, develop clear progression profiles which highlight skills and competencies required at each grade and relevant Skillnet courses.	7 Ensure training alignment with emerging regulations e.g. CSRD[a], IVDR, MDR; develop regulatory upskilling initiatives to attract new talent to the sector.	8 Develop and promote cross-industry skill-sharing in Ireland through networking and collaborative learning opportunities.	9 Promote stronger collaboration between academia and industry to co-design and implement updated upskilling programmes and accreditation options.	10 Establish accelerated medtech programmes and routes for students which integrate internships, apprenticeships, or graduate programmes.

All proposed enablers outlined above were tested during industry focus groups, with near universal approval of all. RD&I in particular highlighted developing transversal skills (#2) as key for their function. Manufacturing attendees felt that cross-industry skill-sharing in Ireland (#8) was essential to increase learning opportunities while Regulatory Affairs and Human Resources were in favour of outlining role progression pathways (#6) and developing supporting training tools (#4) respectively.

Representatives from the Sustainability function noted that all enablers were useful but highlighted that specific sustainability training programmes were urgently needed to support the growth of the Sustainability mindset in medtech (#3).

These enablers should serve as a guide for training providers and industry alike, when seeking to address the broader current and future skills identified for the medtech sector in this report.

Conclusion

Ireland's history of medtech excellence has been underpinned by its workforce, a workforce readily acknowledged as one of the most educated and adaptable in the world. In a high value-add manufacturing industry such as medtech, it is people who make the difference.

In this context, the importance of upskilling, training, and education to the continued vitality of the Irish medtech sector ecosystem cannot be overstated. Ireland has made tremendous strides and is one of the world's most educated nations. However, the medtech industry is changing rapidly. Accordingly, some skills gaps have emerged, and our report highlights these across RD&I, Manufacturing, Regulatory Affairs, Sustainability, and HR.

These problems are real, but solvable, and our report provides a blueprint on how to address them. The Irish Medtech Skillnet, and other members of the medtech ecosystem, have committed to ensuring the Irish medtech workforce reaches its full potential and are ready to address both current and future skills needs.

In productivity, patents, and number of people employed, Ireland's medtech industry is among the leading nations of the world. However, challenges lie ahead, including in sustainability, digitalisation, and the shift towards advanced manufacturing. Nevertheless, the willingness of the medtech workforce to engage in solution-driven discussions during the development of this report, demonstrates the drive to address and overcome these challenges.

In 2028 and beyond, driven by an unwavering commitment by its world-class workforce, government departments, state agencies and related educational and enterprise stakeholders, we fully expect Ireland to continue to play its part as one of the leading global medtech hubs.

Irish Medtech Skillnet

Irish Medtech Ibec

Skillnet IRELAND

KPMG

13 Appendix

Acknowledgements

The analysis in this report is built on a rigorous primary research foundation. Irish Medtech Skillnet would like to acknowledge and thank all the ecosystem participants who took part in consultations and responded to the survey.

We would like to to convey sincere gratitude and appreciation towards the individuals and organisations that have played a pivotal role in the development of this report. We wish to acknowledge their support, guidance, and exceptional expertise, which have all been instrumental in ensuring the report's value.

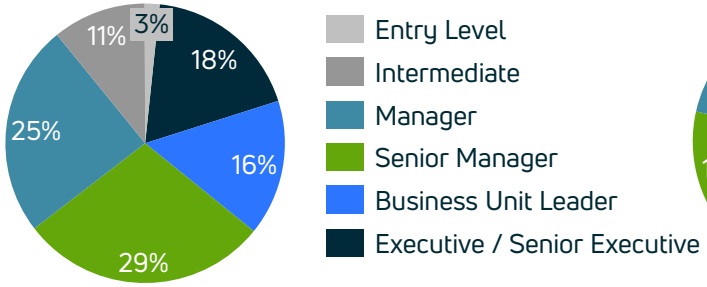
Representatives from the following organisations, all of which have participated in this project:

- Advanced Oxygen Therapy
- Aerogen
- Alcon
- Atlantic Technological University
- Bellurgan Precision Engineering
- BioInnovate
- BioPharmaChem Ireland
- Boston Scientific
- Complete Laboratory Solutions
- Coillte
- Cook Medical
- DePuy Synthes
- Freudenberg Medical
- IDEAM Industry Cluster
- I-Form Advanced Manufacturing Research Centre
- Irish Medtech Skillnet Steering Committee
- Johnson and Johnson
- Kenvue
- Kyzentree
- LUMA Vision
- Medtronic
- Mergon
- Neurent Medical
- Serosep
- SmartFactory
- SteriPack Ireland
- Stryker
- Teleflex
- Teneo
- Transitions Optical
- Trinity College Dublin
- Tyndall National Institute
- University of Galway
- Veryan
- West Pharma

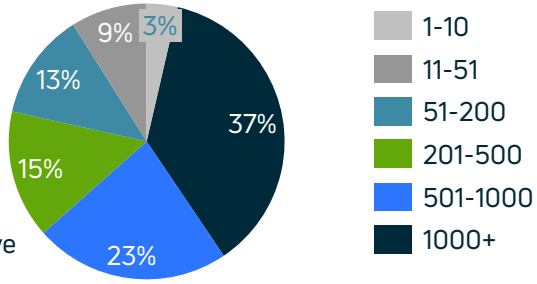
Ireland medtech survey: Key demographics

Our local survey of >400 employees was representative of the Irish medtech industry and its predominantly multinational employers. Most respondents were university educated, of senior rank, and had direct reports.

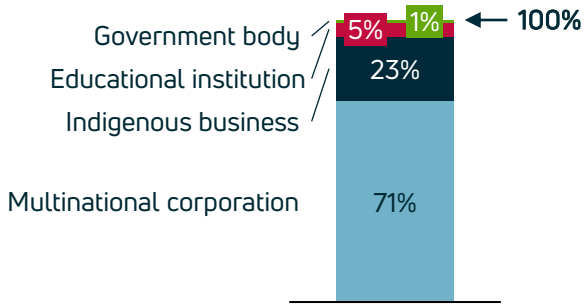
1 Level of seniority[1]



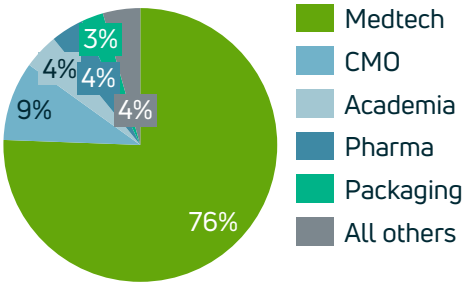
4 Company employees in Ireland[1]



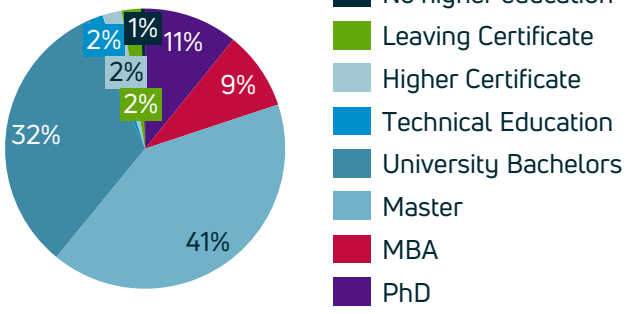
2 Organisation type[1]



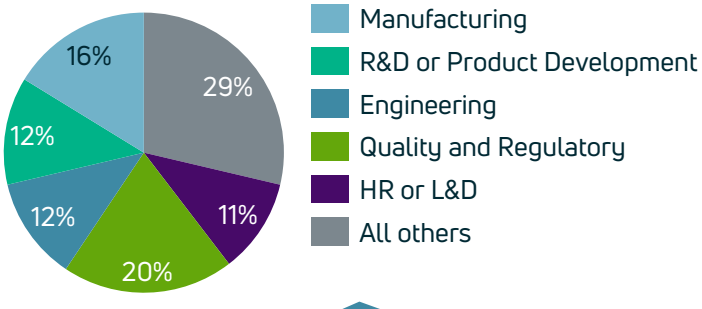
5 Respondent industry[1,2]



3 Level of formal education[1]



6 Functions of respondents[1]



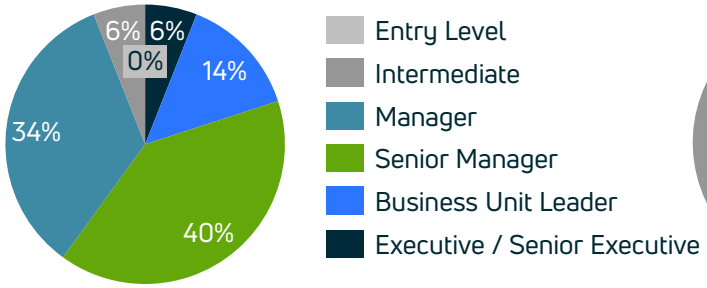
This includes a wide variety of functions including Commercial, IT, Finance, Validation, Process Development, and others, including managerial respondents.

Notes: **[1]** n=407 respondents based in Ireland, **[2]** respondents not directly employed by a medtech company are specifically serving the medtech industry.

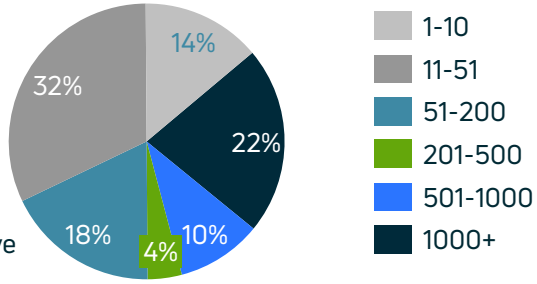
Singapore medtech survey: Key demographics

Our survey collected views from a variety of individuals in Singapore, with ~60% at senior manager level or above and 54% from a multinational corporation. Respondents were from a variety of functions and medtech sectors.

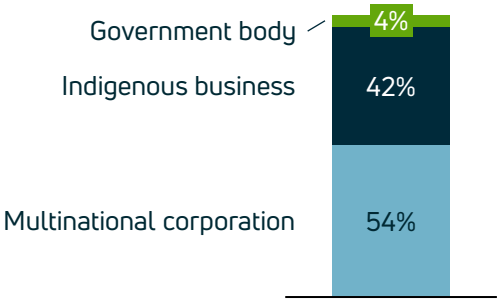
1 Level of seniority[1]



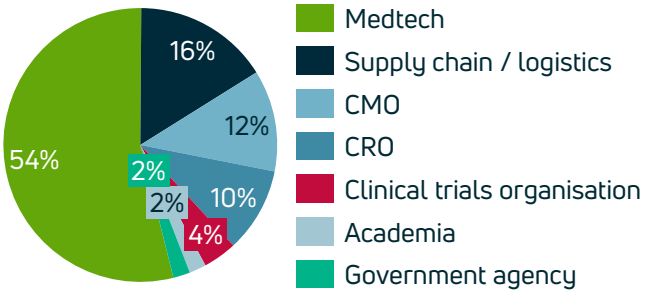
4 Company size in Singapore[1]



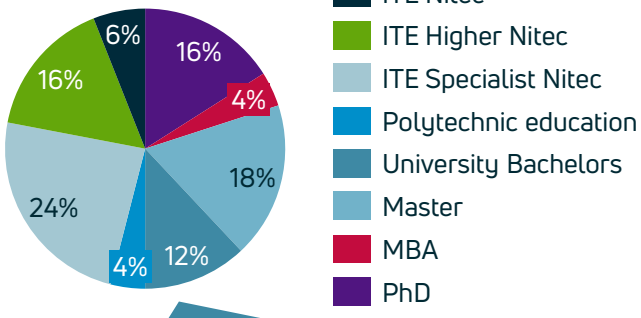
2 Organisation type[1]



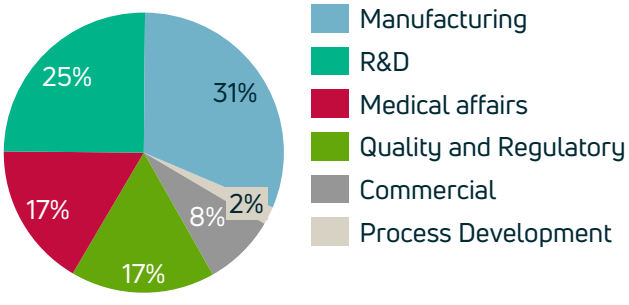
5 Respondent industry[1,2]



3 Level of formal education[1]



6 Functions of respondents[1]



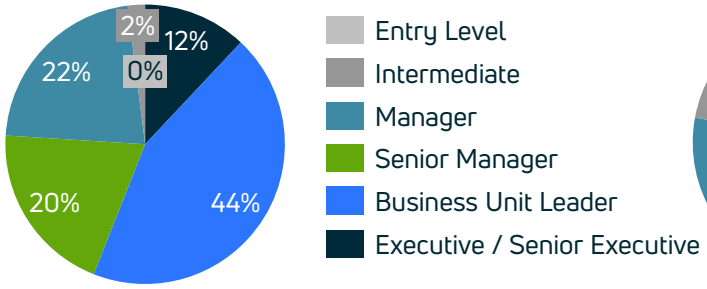
Technically educated respondents made up ~40% of Senior Manager or higher roles in our survey, and 50% of overall respondents. There may be scope in Ireland to better create pathways to leadership for such individuals.

Notes: **[1]** n=50 respondents based in Singapore, **[2]** respondents not directly employed by a medtech company are specific serving the medtech industry.

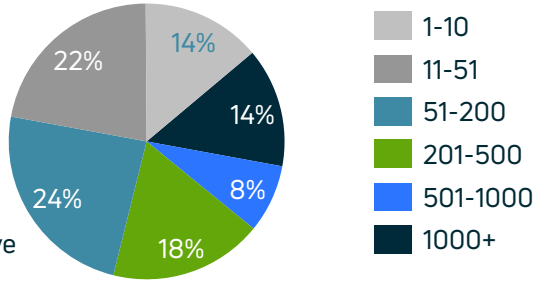
Minnesota medtech survey: Key demographics

Our survey collected views from a variety of individuals in Minnesota, with ~76% senior manager level or above and 28% from a multinational corporation. Respondents were from a variety of functions and medtech sectors.

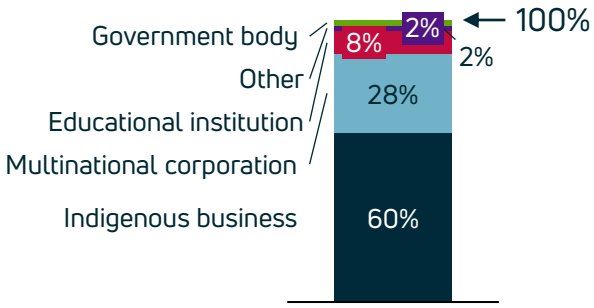
1 Level of seniority[1]



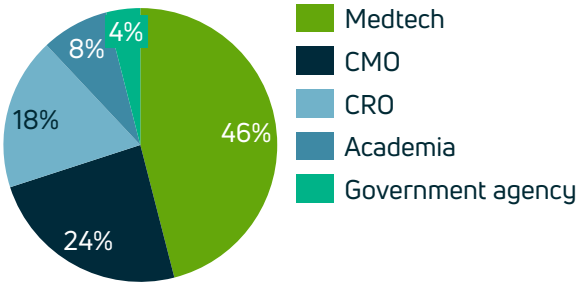
4 Company size in Minnesota[1]



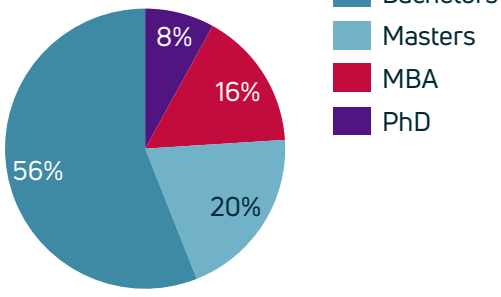
2 Organisation type[1]



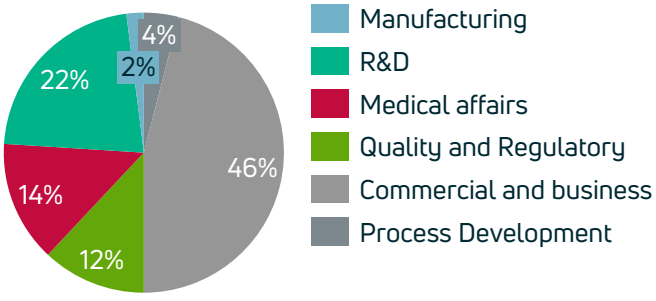
5 Respondent industry[1,2]



3 Level of formal education[1]



6 Functions of respondents[1,3]



PhD respondents were all business unit leads across their organisation.

Notes: **[1]** n=50 respondents based in Minnesota, **[2]** Respondents not directly employed by a medtech company are specific serving the medtech industry, [3] Commercial and business includes the following functions: Supply chain, I.T., HR, commercial, fiancé and learning and development.

References

All weblinks live as of September 2023.

1. Statista; Accessed at: https://www.statista.com/outlook/hmo/medical-technology/medical-devices/worldwide#revenue
2. Ibec "Where Digital Health Thrives: Future Skills Needs" (2023)
3. Medtech Europe " The European Medical Technology Industry in figures 2023" (2023). Accessed at: the-european-medical-technology-industry-in-figures_2023-1.pdf (medtecheurope.org)
4. European Commission "Pact For Skills: Analysing of upand reskilling policy initiatives and identifying best practices" (2022). Accessed at: https://op.europa.eu/en/publication-detail/-/publication/c9ca33f2-ca45-11ee-95d9-01aa75ed71a1/language-en/format-PDF/source-306922043
5. BioInnovate "What We Do" (2024). Accessed at: Ecosystem - BioInnovate Ireland - Innovative Medical Device Training
6. The Irish Times "Enabling Ireland to become a recognised global hub for digital health" (2023). Accessed at: Enabling Ireland to become a recognised global hub for digital health – The Irish Times
7. European Patent Office "Granted patents 2014-2023". (2024)
8. BioInnovate "History" (2024). Accessed at: History - BioInnovate Ireland - Innovative Medical Device Training
9. KPMG "The research and development tax credit in detail" (2023). Accessed at: The research and development tax credit in detail - KPMG Ireland
10. Skillnet Ireland "Up to 74 percent of medtech businesses plan to increase RD&I in Ireland" (2019). Accessed at: Up to 74 percent of medtech businesses plan to increase RD&I in Ireland - Skillnet Ireland
11. Higher Education Authority "Access Our Data" (2024).
12. Enterprise Ireland (2024).
13. BioPharmChem Ireland Strategy 2022. Accessed at: https://www.ibec.ie/connect-and-learn/industries/life-sciences-and-healthcare/biopharmachem-ireland/bpci-strategy-2022
14. The Irish Medech Association "The Global medtech Hub 2025" (2022). Accessed at: medtech Strategy 2025 – IBEC
15. BioPharmaChem Ireland (BPCI) "A strategy for the sector 2023 – 2027" (2022). Accessed at: BPCI Strategy 2022 – IBEC
16. EuroStat "Prodcom – statistics by product" (2021). Accessed at: Overview - Eurostat (europa.eu)
17. Central Statistics Office (CSO) "Information and Communications Technology: A Value Chain Analysis 2019" (2019). Accessed at: Producers Information and Communications Technology: A Value Chain Analysis 2019 - Central Statistics Office
18. Technology Ireland Ibec "Technology Ireland Strategy 2022 – 2026" (2022). Accessed at: Technology Ireland Strategy - Technology Ireland (ibec.ie)
19. Bord Bia Irish Food Board "Export Performance and Prospects Report 2022 – 2023" (2023). Accessed at: 2022 - 2023 Export Performance & Prospects (bordbia.ie)
20. IDA Ireland "Tapping Irish Talent to Drive Tech Companies" (2023). Accessed at: Tapping Irish Talent to Drive Tech Companies | IDA Ireland
21. European Patent Office "Country Reports 2022" (2022)

References

All weblinks live as of September 2023.

22. Linkedin (2023)
23. Ibec "Employee turnover report 2022" (2022)
24. Career Wise, Minnesota State. (2023)
25. Coursea, University of Minnesota (2023)
26. Career Force (2022)
27. National University of Singapore (2023)
28. A*STAR "Singapore BioDesign Program" (2023) . Accessed at: https://www.a-star.edu.sg/sb
29. Forum Reimbursement and Market Access Germany (2023)
30. Kiwa Medical Device Quality Management (2023)
31. Coursera, University of Glasgow (2023). Accessed at: University of Glasgow Online Courses | Coursera
32. Ulster University (2023)
33. Arizona State University (2023)
34. CSO "Census of Population – 2022" (2022). Accessed at: Population Changes - CSO - Central Statistics Office
35. Department of Statistics Singapore (2023). Accessed at: DOS | SingStat Website - Singapore Population
36. United States Census Bureau "Minnesota" (2022). Accessed at: U.S. Census Bureau QuickFacts: Minnesota
37. The World Bank – Costa Rica (2022). Accessed at: Population, total - Costa Rica | Data (worldbank.org)
38. Office for National Statistics "Population estimates for the UK, England, Wales, Scotland and Northern Ireland: mid-2021" (2022). Accessed at: Population estimates for the UK, England, Wales, Scotland and Northern Ireland - Office for National Statistics (ons.gov.uk)
39. Destatis: Statistices Bundesamt "Current population of Germany" (2023). Accessed at: Current population of Germany - German Federal Statistical Office (destatis.de)
40. Central Statistics Office Census (2022)
41. Irish Medtech IBEC (2022)
42. Statista Market Share medtech for 2020 (2022)
43. Statistics Singapore (2023)
44. Government of the Netherlands: medtech RD&I Singapore (2022)
45. Minnesota State Demographic Centre (2022)

References

All weblinks live as of September 2023.

46. AdvaMed "The Economic Impact of the Medical Technology Industry" (2021). Accessed at https://www.advamed.org/wp-content/uploads/2023/06/Medtech-Industry-2021-Economic-Impact.pdf
47. Federal Drugs Administration "Artificial Intelligence and Machine Learning (AI/ML)-Enabled Medical Devices" (2024). Accessed at: https://www.fda.gov/medical-devices/software-medical-device-samd/artificial-intelligence-and-machine-learning-aiml-enabled-medical-devices
48. European Patent Office "Patent Index 2022" (2023). Accessed at: https://www.epo.org/about-us/annual-reports-statistics/statistics/2022/statistics/patent-applications.html#medical
49. Medtech Europe "Ai in medical technologies" (2022) accessed at: https://www.medtecheurope.org/resource-library/ai-in-medical-technologies/
50. Evaluate Vantage, "Medtech research spending set to slow in 2022" (2021). Forecast figures were sense checked for 2022 against data, where available. Accessed at https://www.evaluate.com/vantage/articles/insights/other-data/medtech-research-spending-set-slow-2022
51. Swiss medtech "Swiss Medical Technology Industry – Sector Study 2022" (2022). Accessed at https://www.swiss-medtech.ch/sites/default/files/2022-09/22_2769_SMTI_2022_Englisch.pdf
52. MassBioEd "Massachusetts Life Science Employment Outlook, 2023" (2023) Accessed at: https://media.wbur.org/wp/2023/05/MassBioEd_2023_LS_Workforce_Trends_Report_5.31.23.pdf
53. SNITEM (French National Association for Medical Technology and Industries) report on the industry (2022). Accessed at: https://www.snitem.fr/wp-content/uploads/2022/02/Snitem-Panorama-DM-2022.pdf
54. BVMed (German Medical Technology Association) "Media Seminor 2022" (2022) Accessed at: https://www.bvmed.de/de/bvmed/presse/medienseminare/medienseminar2022
55. McKinsey & Company. "Human Plus Machine: A New Era of Automation in Manufacturing." (2017) Accessed at: https://www.mckinsey.com/capabilities/operations/our-insights/human-plus-machine-a-new-era-of-automation-in-manufacturing
56. Statista "The G7" (2023)
57. The European Union "The AI Act"
58. FDA publication in the US Federal Register / Vol. 87, No. 36. Accessed at: https://www.fda.gov/medical-devices/postmarket-requirements-devices/quality-system-qs-regulationmedical-device-good-manufacturing-practices and at https://www.govinfo.gov/content/pkg/FR-2022-02-23/pdf/2022-03227.pdf
59. European Commission press release "Public health: Commission proposes a progressive roll-out of the new In-Vitro Diagnostic Medical Devices Regulation" (2021)
60. UCLA Biodesign Program / Boston Consulting Group "Interstates and Autobahns: Global medtech Innovation and Regulation in the Digital Age" (2022). Accessed at: https://web-assets.bcg.com/8c/f0/06744e8848ea9654bbd0765bf285/bcg-interstates-and-autobahns-mar-2022.pdf

References

All weblinks live as of September 2023.

61. The European Union "The European Health Data Space"
62. FDA publication in the US Federal Register / Vol. 87, No. 36. Accessed at: https://www.fda.gov/medical-devices/postmarket-requirements-devices/quality-system-qs-regulationmedical-device-good-manufacturing-practices and at https://www.govinfo.gov/content/pkg/FR-2022-02-23/pdf/2022-03227.pdf
63. Federal Drugs Administration "Conducting Remote Regulatory Assessments: Questions and Answers Draft Guidance for Industry". Accessed at https://www.fda.gov/media/160173/download
64. Medtech Europe "Survey Report analysing the availability of Medical Devices in 2022 in connection to the Medical Device Regulation (MDR) implementation" (2022). Accessed at https://www.medtecheurope.org/wp-content/uploads/2022/07/medtech-europe-survey-report-analysing-the-availability-of-medical-devices-in-2022-in-connection-to-the-medical-device-regulation-mdr-implementation.pdf
65. UK Research & Innovation "Challenges and Opportunities for the UK Healthtech Industry." (2023). Accessed at: https://mcusercontent.com/5ba48c3608f8624b9d9697c0f/files/c07e9881-fa6b-6df3-d712-bf8f39140203/Challenges_and_Opportunities_for_the_UK_HealthTech_Industry_FINAL_with_shorter_appendices_PRINT.pdf
66. European Commission press release "Public health: Commission proposes a progressive roll-out of the new In-Vitro Diagnostic Medical Devices Regulation" (2021)
67. UK Government "Life Sciences Vision" (2021). Accessed at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1013597/life-sciences-vision-2021.pdf
68. The European Union "What is the European Green Deal?"
69. European Parliament "Sustainable economy: Parliament adopts new reporting rules for multinationals" (2022). Accessed at: https://www.europarl.europa.eu/news/en/press-room/20221107IPR49611/sustainable-economy-parliament-adopts-new-reporting-rules-for-multinationals
70. HEA "€25.67m in Transformation Funding for Technological Universities announced" (2021). Accessed at: https://hea.ie/2021/09/08/e25-67m-in-transformation-funding-for-technological-universities-announced/
71. Ibec Manufacturing Apprenticeship: Accessed at: https://www.ibec.ie/connect-and-learn/industries/construction-property-and-engineering/Manufacturing-Engineering-Apprenticeships (2024)
72. DFHERIS "Action Plan for Apprenticeships" (2021) Accessed at: https://www.gov.ie/en/publication/0879f-action-plan-for-apprenticeship-2021-2025/
73. Medical Product Outsourcing "Embrace a People-First Approach to Workforce Management" (2022)
74. Randstad Sourceright "Talent Trends" (2022)
75. European Chemicals Agency "ECHA publishes PFAS restriction proposal" (2023). Accessed at: https://echa.europa.eu/-/echa-publishes-pfas-restriction-proposal

Irish Medtech Skillnet

Irish Medtech Skillnet,
Ibec West,
Gardner House,
Bank Place,
Charlotte Quay,
Limerick

E irishmedtechskillnet@ibec.ie
W https://irishmedtechskillnet.ie/

Irish Medtech Skillnet is co-funded by Skillnet Ireland and network companies. Skillnet Ireland is funded from the National Training Fund and the European Union through the Department of Further and Higher Education, Research, Innovation and Science.

Skillnet IRELAND

Rialtas na hÉireann
Government of Ireland

Co-funded by the European Union