Ireland Where Digital Health Thrives

An Ibec Campaign

Irish Medtech Association
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Matt Moran
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Directors' welcome

Ireland, a global hub for digital health

We speak to the directors of the Irish Medtech Association, BioPharmaChem Ireland and Technology Ireland, to find out what digital health means for their respective industries and why Ireland is becoming a thriving centre for digital health.

Revolutionising healthcare

"Increased demand for services, ageing populations and the rise of chronic disease are just some of the reasons why healthcare spending is rising" Sinead Keogh Director, MedTech & Engineering says. The latest figures from the Organisation for Economic Co-operation and Development (OECD) reveal that there was an estimated 2.5% spending growth in 2018.

To tackle rising costs she notes that, "Many businesses are embracing value-based health care which links the cost to the quality of patient outcomes". This reimbursement model is underscored by innovation in both products and services to deliver more holistic healthcare solutions. She says "Many medtech companies are now future-proofing their research and development (R&D) departments towards complete care solutions, looking at how digital technology can not only improve outcomes, but also improve the patient experience."

Sinead explains that, "Digital health is revolutionising healthcare with more personalised technologies and healthcare solutions. Hospitals account for 40% of health spending, but digital health empowers patients and helps them get on the right care pathways."

'Where Digital Health Thrives'

As part of this campaign 'Where Digital Health Thrives' we wanted to capture the scale and scope of the digital health ecosystem already here. We have mapped nearly 200 companies, who are already delivering digital health solutions here in Ireland, and I'm sure there are many more. Market segments include, telehealth, data, analytics and cyber security, health information technology, connected medtech, mobile health and more.

She continued, "Ireland is recognised as a top 5 global hub for medtech, and it's our ambition to make Ireland a go-to-destination of choice for digital health."

"We're uniquely placed to become a leader in this field with 9 of the world's top 10 medtech companies, 10 of the top 10 tech companies and 10 of the top 10 biopharma companies all having a base here. Moreover, with sales of €15.7 billion forecast in digital health by 2024, and strong growth projections year on year, it's an attractive area to drive growth, innovation and transform healthcare."

"If there's one thing that Covid-19 has taught us, it's that we needed to change our healthcare delivery system," Sinead adds. "Health spending before Covid-19 was an average 8.8% of GDP in the OECD. Management of health spending has had to adapt to face the challenge of the pandemic, this is unsustainable, but Covid-19 has increased the adoption of digital health solutions in the health system"

"With hospital visits being stopped and the reluctance of people to come into a hospital or a clinic, a lot of physicians have moved online with telemedicine and home monitoring. So, while we had this type of technology before, the crisis has accelerated the demand for, and acceptance of, digital health across many health systems globally"

Implications for life sciences

Matt Moran, Director of BioPharmaChem Ireland says that as an association, they aim to further the digital health industry to benefit society at large. "It melds together monitoring biomarkers within the body, with therapy to help the patient have a better outcome" Matt remarks.

"Sick patients use virtual tools to speak to a doctor to get better, and people are using these tools to make sure they don't get sick in the first place," says Matt.

"We already have many examples of how this collaboration is working. Diabetes is one of the areas where digital health can be especially useful as it needs to be constantly monitored. We have seen digital health tools such as glucose monitoring tools. This sees every one of the three industries come together to solve an issue for patients. That level of engagement is why Ireland is a great place for digital health to progress even further."

"We can see many more digital health products and services emerging here. To have them commercialised and made in Ireland will help the industry and economy going forward."

Ibec, bringing industries together

Matt says not only will the patient benefit from the use of digital health, but the country as a whole will also benefit from being engaged in this next wave of digital therapeutics. "There are challenges to bringing together the three different industry sectors of biopharma, medtech and tech, along with the burgeoning digital health sector."

"But in Ibec, we have representative bodies for these industries all under one roof. This helps with collaboration between them all and the Ibec Digital Health Working Group is bringing leaders and experts together to develop the business supports and shape policies for success. The 'Where Digital Health Thrives' campaign is the organisation's first cross-sectoral initiative of its kind and we see great opportunity to use this approach to deliver results that matter to members."

Technology supporting efficiency

Digital health has been around as a concept for many years now. But it is only within the last few years that the industry has become such an innovative space. Una Fitzpatrick, Director of Technology Ireland says that currently, there is a big push in terms of new technology, and how those can be applied in a healthcare setting.

"When we refer to digital health, I think some people have concerns about big data companies and artificial intelligence," says Una. "They might also be fearful of the idea of technology and 'robots' looking after them. But it's really just another tool in the armoury." Una believes it will never replace the human element of healthcare, but it is a technological tool to make it more efficient and accurate.

Improving quality of care

"The European Commission set out its Covid-19 recovery response to help improve the EU's response to future epidemics and pandemics. This has allocated a significant budget to all member states. It's really heartening to see that 20% of that is going to be focused on digital healthcare. That's a lot of support for this industry as a response to Covid."

Una adds, "This creates a huge opportunity for Irish companies. We have a strong tech community here, and we are able to identify what the biggest needs are. So, with European support, these companies can scale up and create partnerships with other jurisdictions too."

Una says there are challenges to the wide adoption of digital health, such as getting stakeholders to commit to making changes. But as there are so many benefits and cost savings associated with digital health tools, this adoption won't take too long.

"We want Ireland to be a location where all stakeholders and all participants in the digital health care sector can participate fully. There is such a creative community across tech, medtech and biopharma with access to the fantastic talent here in Ireland too. I see an openness and the ability to innovate here and this is going to take digital health and Ireland as a location to a whole new level on a global scale."

Chair's introduction

> "Digital health is the intersection of healthcare and technology. The goal is to translate the benefits that technology has brought to other industries and bring them to healthcare."

How Ireland's history positions us for future success

John O'Brien, Chair of the Irish Medtech Association, and Chief Executive and Executive Chairman of S3 Connected Health, talks about why digital health is so important and Ireland's thriving digital health industry

Fertile ground for innovation and growth

Ireland is unique in that it has several key ecosystem advantages. It is a small and well-networked country. There is also a worldclass network of innovation centres with a focus on many of the multidisciplined aspects of digital health, from medical research to cybersecurity and data science.

"All of this mixed together creates a really fertile ground for doing digital health innovation in Ireland and exporting that innovation to different markets," says John.

"Ireland has a history of large companies setting up in Ireland, as a launchpad into Europe. A lot of our startups and SMEs are also built towards looking internationally. Our proven ability to attract and build companies in this mode is a perfect model for digital health."

Ireland's potential

John says that the Ibec Digital Health Working Group is committed to fulfilling Ireland's massive potential for digital health by enabling Irish companies to develop and commercialise digital health solutions while encouraging the adoption of new technologies.

John says, "Here in Ireland, we have companies which are working in digital health across the spectrum. This includes medtech companies working on connected medical devices to digital therapeutic companies developing software-based therapies. And everything in between with companies working on remote patient monitoring, digital clinical trials, and health analytics. It's a really active area in Ireland."

Ireland also has a wide range of research organisations relevant to digital health, from clinical research, to creating regulated software. But underpinning it all is data. "Any of the software that is developed around this area has to be very mindful of data protection. So, cybersecurity is a key component here too and there's a lot of that expertise in Ireland."

Technology adoption

"Digital health is the intersection of healthcare and technology. The goal is to translate the benefits that technology has brought to other industries and bring them to healthcare."

John notes that, "A great example of patients being helped through digital health is those with diabetes who are using continuous glucose monitors. This is a patch that you put on your arm that connects to a reader or a smartphone. It gives the diabetic patient a continuous reading of their glucose levels. This gives data to the patient, allowing them to take much more control over their condition."

John says that this kind of empowerment of patients also helps to support healthcare professionals, "As we're projected to have a significant shortage of doctors over the coming years, we're going to have to help them make better decisions faster with actionable data insights."

John continues, "If you want to bring efficiencies to healthcare, you need to understand the incentives in the health system and also the shift from payment for services to payment for outcomes. And that's where data comes in. Once you can measure outcomes, you can measure effectiveness."

Bringing people together

John says there are many partnerships taking place between large medtech companies and pharma companies, along with innovative Irish startups and SMEs. This is an important development, as it is a sign that the rich ecosystem in Ireland is working together.

But of course, this ecosystem wouldn't be possible without the talent which keeps the system going. Irish talent helps digital health thrive in Ireland.

"Digital health is an attractive industry for people to work in, because it gives people an opportunity to develop solutions that save and improve lives. And as we look to the future we must continue to attract and develop talent to create a real innovative environment."

"We have highly productive people who are ranked the most productive in the world. We also have one of the largest percentages of 24-64 year olds with tertiary education as well as opportunities for industry-led lifelong learning with programmes like Skillnet Ireland. Lastly, our culture makes us very welcoming to mixed discipline approaches and mixed cultural approaches. This is essential for a successful digital health solutions.

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Ibec Digital Health vision and strategic pillars

Vision

To enable Ireland to become a recognised global hub for digital health, where companies can develop and commercialise products, as well as attract projects and investments.

Ibec Digital Health strategic pillars

1.

Build awareness of the value of digital health products and solutions:

By showcasing how digital health, empowers patients, supports health care professionals, and improves health systems. As well as promote Ireland as a location of choice for both startups and FDI multinationals to develop and commercialise digital health products, as well as attract projects and investments.

2.

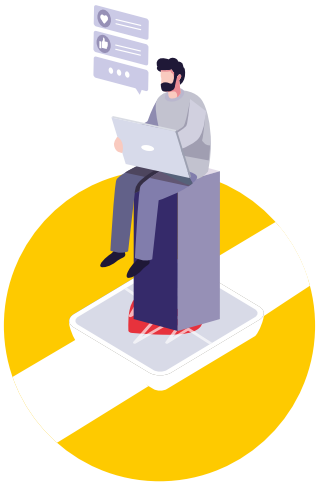
Represent the digital health sector:

By engaging with Government, state agencies, and international policymakers to help the sector innovate and grow with the right policies and infrastructure.

3.

Deliver industry foresight to members:

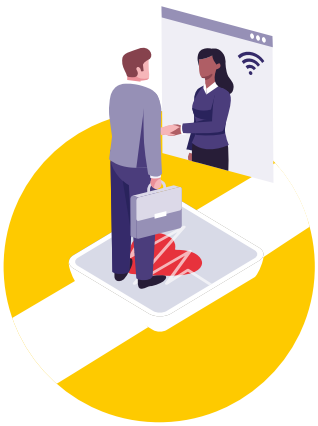
By offering insights on the latest policy and market developments affecting members through meetings, events, and collateral, with opportunities to share best practice and network.



4.

Support the development of a worldclass talent pool for the digital health sector:

By attracting mobile talent, as well as supporting the upskilling and reskilling of the digital health sector by growing the Connected Health Skillnet.



5.

Build partnerships in the digital health sector:

By bringing together key sectors such as the medtech, technology, and biopharma industries, along with key opinion leaders and clinicians, to develop and deliver digital health solutions.

Policy priorities

As Ireland's most influential business representation organisation Ibec advocates for policies that matter to business. We lobby both Government as well as international policymakers to create the right conditions to help our members achieve their potential and grow.

Ciara Finlay, Senior Executive, Irish Medtech Association, outlines the Ibec Digital Health Working Group policy priorities to ensure that digital health in Ireland thrives.

Government support: Prioritise digital health opportunities with a whole Government approach to ensure Ireland has the right resources and a roadmap for the digital economy that includes digital health development and adoption as a priority.

Competitiveness: Ensure global competitiveness by reforming the Capital Gains Tax system, Key Employee Engagement Programme (KEEP), making changes to the Employment Investment Incentive Scheme (EIIS) to bring us in line with international best practice, as well ensure that Ireland has the right business policies to attract foreign direct investments.

Investment: Set targets for investing in digital health services and supports to ensure that Ireland's digital health infrastructure and services foster a modern health system.

Talent: Build capacity for diverse healthcare talent with upskilling and reskilling through the Connected Health Skillnet, as well as revise university curriculums to include key subjects as data science, artificial intelligence, and health economics.

Innovation: Encourage business to drive disruptive innovation and accelerate the development of digital health solutions across key sectors such as medtech, technology and biopharma with collaboration between industry, clinicians, and researchers.

Market Access: Complete the European Digital Single Market, and expand coverage of digital health with a Digital Health Act, similar to Germany's, to make Ireland a location of choice to develop, launch and adopt transformative digital health solutions that improve outcomes while lowering costs.

Regulatory pathway: Ensure that the regulatory pathway for digital health products and solutions is fit-for-purpose to optimise patient access to life changing innovations.

Health system engagement: Encourage collaboration between policymakers, business, and clinicians to identify unmet clinical needs and facilitate the effective adoption of digital health solutions into the health system.

Patient centricity: Put people at the centre of their treatment in an informed and supported manner at the appropriate point in patient care pathway, with digital health solutions such as personalised medicine, connected devices and remote monitoring, in hospitals as well as in the community.

Data privacy and security: Build trust and support best practice with a harmonised approach that ensures interoperability, data privacy and security, underscored by standards for the processing of primary and secondary data.

How digital is transforming healthcare

Innovations in digital health have been emerging in Ireland for many years, but the demand has been accelerated under Covid-19 with technologies such as remote diagnosis, data insights and connected devices supporting care delivery in and out of the hospital. As we look to the future, digital health products and solutions can help ensure more sustainable health system models that improve outcomes while reducing costs. Greater technology adoption in hospitals, as well as by health care professionals and patients will be essential to reap the benefits of this dynamic industry.

Creating a sustainable health system

Martin Curley, Director of Digital Transformation and Open Innovation at the Health Service Executive (HSE), discusses why there is an urgent need for digital transformation in Irish healthcare.

"Without the introduction of digital, our healthcare system won't be sustainable," says Martin Curley, who has an extensive background in digital strategy, having worked with Intel Corporation and Mastercard prior to working with the HSE. "And Covid-19 has actually accelerated the demand to move to digital."

Martin shares an example of a solution the HSE introduced as a result of the pandemic, "It was a remote management solution for patients with Covid-19. Instead of patients with mild to moderate symptoms being hospitalised, we were able to monitor them at home using an app and a Bluetooth-enabled pulse oximeter, which measures a person's blood oxygen levels."

Martin says they reached a peak of over one thousand patients being monitored through the solution and this meant the healthcare system had the capacity for sicker patients. "It also meant that the patients at home had the opportunity for a better quality of life and at least the same care as they would have received in hospital."

Leading with ambition

Martin, who became Chief Information Officer (CIO) at the HSE after his roles at Intel and Mastercard, says he joined the HSE after seeing "real opportunity to apply digital technology, to deliver better patient outcomes and do things more cost-efficiently".

He says, "I could see that healthcare in Ireland was almost a decade behind other industries."

Today, he is Director of Digital Transformation and Open Innovation at the HSE, with the aim of helping to enable the digital transformation of Ireland's health service.

"We have an ambitious plan to become a European digital health leader within five years," he explains. "And we have a strategy in place called 'Stay Left, Shift Left'."

'Stay Left, Shift Left' is based on partnering with innovative companies, universities and individuals to utilise the power of digital applications, data and technology, in order to improve quality of life and quality of care, while reducing the cost of care.

"The concept of 'Stay Left' is to use technology to keep people well in their homes, and allow people with chronic conditions to manage themselves in the best way possible at home.

"'Shift left' is about finding technologies that help people move as quickly as possible from the acute setting to a community setting and finally, to a home setting."

Martin stresses the Irish health system urgently needs these types of interventions, "Interventions that either give a 10x improvement in capability, or a 10x cost reduction. And we are finding that digital solutions do either of these aims or even both of them together."

"The concept of 'Stay Left' is to use technology to keep people well in their homes, and allow people with chronic conditions to manage themselves in the best way possible at home."

Driving change

Martin, who wrote a book called 'Open Innovation 2.0', says partnership and collaboration are important in driving this change to digital.

"My book is about how to use digital technology to drive a structural change in an industry. And that's what we're trying to accomplish in the HSE. We're partnering with so many companies, academics and policymakers, as well as large and small pharma and technology companies, who are all aligned around this common shared vision of 'Stay Left, Shift Left'.

"By working together, we can achieve far more."

Martin continues, "Ireland is small enough that we can effect change on a national basis, but we're also big enough to be credible internationally. If Ireland is able to transform its health system in a structural way, the rest of the world will see how credible the country is and the capability we have.

"The only way we can have a sustainable health system will be to use technology to improve quality of care and quality of life. Digital really is the best medicine for our health care system."

Digital health empowering people

Derick Mitchell, CEO, and Ava Battles, Chairperson of the Irish Platform for Patient Organisations, Science and Industry, on why digital health is about much more than technology.

"Digital health traditionally tends to be looked at from the point of view of information technology (IT)," says Derick Mitchell. "In fact, digital health is far more than IT; it's about people and the voice of the patient.

"It's about identifying new ways of solving the problems that exist in our healthcare, creating better experiences for both patients and the HCP (Health Care Professional)."

The Irish Platform for Patient Organisations, Science and Industry (IPPOSI) brings together patient groups, scientists, clinicians, industry and other key decision-makers, to discuss issues relevant to those involved in delivering treatments. IPPOSI plays a pivotal role in bridging the gap between patients, science and industry and the decision-makers.

And Derick says one such way to create better experiences for patients and efficiencies for healthcare organisations, is by transforming patient records from a paper-based system to an electronic-based system. "We need to implement a National Electronic Health Record sooner rather than later.

"Currently, it's not easy for patients to access their records, but if patients were to have access to an electronic record of their medical information, it would improve their engagement and also patient-HCP relationships."

Derick says patients may feel more empowered to use the data and recognise the value of it, taking a more active role in their own care, "The patient can also play a part in how that data can be used appropriately to make more informed decisions and improve the health system as a whole."

Lack of connectivity

However, Derick says there is currently a lack of connectivity between data collection systems in healthcare facilities. "The ways that healthcare data is stored, shared, standardised, and regulated vary across communities, agencies, health systems, and providers."

This can lead to issues interpreting shared data and matching patient records across systems.

"There are certain building blocks involving the integration of information that need to be in place. One such building block would be that whoever is collecting data would have the knowledge and training to allow them to input the data in a way that reaches a certain minimum standard across healthcare."

Ava Battles says that very often, the best solutions don't come from just the IT experts. "The best solutions come from the people who are the frontline workers. Those who have direct experience of where there are gaps or deficiencies in the current health service."

IPPOSI has been involved with a number of new courses including a UL-HSE-led MSc in Digital Health Transformation, which Derick says has been a positive experience,

"Not only for the 50+ healthcare professionals on the course, but also from the patient perspective. This is because we have introduced a patient 'Dragons Den' into the programme, as we feel HCPs have great ideas about how problems can be solved through digital health.

Ava says its about making sure that those ideas produce benefits for the patients. "So, a lot of these digital solutions would benefit from the input of patients at the earliest possible stage."

IPPOSI also runs a successful patient education programme in health innovation and is seeking to add new modules on 'patient data' to the programme curriculum.

Maximising data

According to Derick, the more people that are aware of the value of quality health data, the more rapid improvement and digitisation of the service there will be.

"You can have the best IT system in the world, but if you don't have the people to use it in a way that maximises the data, then you really won't reap all the potential benefits from it."

Derick says in order for Ireland to be a leader in digital health, we need to engage with the multinational health companies based here. "Not just to see where digital health would improve their processes and products, but also to engage the staff in those companies. So that they know the value of having better quality health information and recognise the current difficulties in the Irish health system.

"As a result, staff will be conscious of the opportunities within the company to do something that's relevant to Ireland and for Irish patients. With that kind of a motivation factor, innovation can come from the most ordinary of backgrounds."

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The future of medicine

NUI Galway Professor of Medical Device Technology and Consultant Physician at University Hospital Galway, Professor Derek O'Keeffe talks about how digital health technology is going to be a major part of medicine in the years to come.

"With medical problems, there can be digital solutions," says Professor Derek O'Keeffe, who holds a unique position in medicine, as he is both an engineer and a physician. "I'm what is referred to as a 'Physicianeer' which I think is a good mix for innovation.

"Combining clinical skills with digital and engineering skills is a good way forward for the industry. It creates patient-focused solutions by applying problem-solving competencies within healthcare."

One of these solutions is the 'JediGlove' – a new piece of technology for the visually impaired which sends micro-vibrations through the users' fingers and thumb proportional to an object's distance. This helps them sense obstacles in their path. This was developed by researchers at NUI Galway's Health Innovation via Engineering (HIVE) Lab, led by Derek.

"We nicknamed the device the JediGlove because it lets someone who is visually impaired 'feel the force' of objects in their environment. I realised there weren't many solutions for blind people, and they could be helped with digital technology. This is a great example of a patient-focused approach."

Managing health in a crisis

It's not just everyday clinical problems that digital tools can help with. It can also be used to manage diseases, such as the global Covid-19 pandemic.

Professor O'Keeffe was part of a global task force which examined the role of mobile health (mHealth) technologies during the coronavirus pandemic.

Professor O'Keeffe says, "Before Covid-19, clinics had been doing things the same way for decades. I wondered why we were bringing people from an hour away into a waiting room to wait for another hour just to see a doctor for 10 minutes. It didn't make any sense. I did a TED talk on 'Digital Doctors' in 2019, so it was an emerging idea even before the pandemic. So, when Covid-19 happened, I was called for my input on how to set-up remote consultations.

"When I came back from giving an invited key opinion leaders digital health lecture at the WHO in February 2020, my hospital immediately asked me to help create virtual appointments for our physical outpatients. Virtual doesn't have to be futuristic 3D holograms, it can simply be a phone call or audiovisual software. In our diabetes clinic, we didn't have to cancel one outpatient appointment because we embraced technology early."

Professor O'Keeffe says this proves that digital health technology is ready to be a major tool in helping manage Covid-19. He says virtual care is able to reduce the spread, while keeping patients happy and healthy.

"If we were to suddenly stop all the outpatient appointments," says Professor O'Keeffe, "our patients with chronic diseases would likely decompensate and have to go through the emergency department for clinical review and then they would have a greater risk of catching Covid-19.

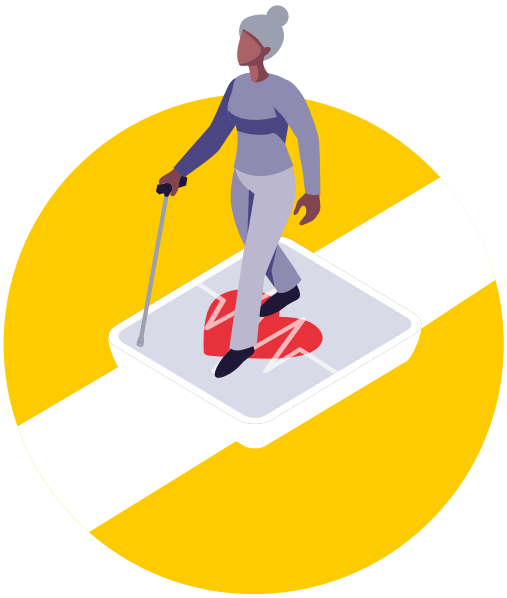
"Many clinics who believed they didn't have digital tools to do this actually did – we all have phones with Zoom, Skype, and so many more solutions with many meeting the criteria we need for data protection. Just choose the best one for now as there is no need to overcomplicate it."

Professor O'Keeffe says virtual care was something Ireland had already been creating, but it wasn't until something shook up the industry that it was implemented. He says his mHealth report highlighted these shortcomings of healthcare systems and governmental policies. It also proves that it is possible to implement remote patient-to-physician monitoring solutions.

"I think Ireland is extremely well placed to be at the forefront of this new digital health age. Nine of the world's top 10 medical technology companies are in Ireland, we have an amazing graduate workforce, and industry expertise. Furthermore we are launching Europes first dual training medical-engineer (Physicianeer Program) in Ireland in 2021"

Ireland can be world leaders in this industry and the innovations that have already come from this country are a testament to that."

"Virtual doesn't have to be futuristic 3D holograms, it can simply be a phone call or audiovisual software. In our diabetes clinic, we didn't have to cancel one outpatient appointment because we embraced technology early."



Working across the health sector

Dr Steven Griffin, Health Innovation Hub Ireland Manager at National University of Ireland Galway (NUIG) and Eimear Galvin, Health Innovation Hub Ireland Manager at Trinity College Dublin, talk about how digital health is helping to address problems in healthcare and the economic opportunities of the industry.

"Our primary mission is to connect industry with healthcare and vice versa," says Steven Griffin. "Health Innovation Hub Ireland (HIHI) works as a nexus between the clinical, technical and commercial areas of the medtech industry, to help move ideas or products towards the market or towards implementation."

HIHI is a national network of innovation hubs in Cork, Dublin, and Galway was established by the Department of Business, Enterprise and Innovation and the Department of Health in 2016. It is supported by Enterprise Ireland and the Health Service Executive (HSE) to drive collaboration between the health service and enterprise to develop new innovative solutions. To do this, they connect enterprise with Ireland's leading health professionals to validate and pilot products.

The HIHI team consists of people with clinical, commercial, innovation, technical, and design backgrounds with half of the team from the HSE. HIHI is on the ground with a national network across Irish acute sites offering a unique ability to navigate the Irish healthcare system for companies and understand the nuances required to implement a solution.

Eimear says, "Digital health products and solutions, in particular, are quickly becoming the majority of healthcare solutions from what we've seen. These solutions are created for unmet needs and challenges in healthcare, which we identify and verify as actual requirements.

"We have an ageing population, which leads to an increase in chronic diseases. This puts a lot of pressure on the system as people have to be monitored all the time. Digital health allows a shift towards community health and at-home care with remote monitoring, where the patient is wearing a wearable device. The data can be quickly uploaded to the healthcare provider so they can make decisions going forward without having to waste time and money."

Innovation during a pandemic

Steven says that when Covid-19 hit, it kick-started the adoption of a lot of digital solutions, leading to a major shift towards digital health solutions in Ireland in the last six months.HIHI recently triaged 200 innovative healthcare solutions through its Covid-19 Innovation Portal, which helps the healthcare system meet the demands of the pandemic. The HIHI Covid-19 portal was set up to connect businesses with solutions to problems created by the pandemic. "With the healthcare solutions we received, over half of them were digital solutions," says Steven.

Some of these solutions include the adoption of technology to connect patients and clinical teams, electronic prescriptions, and the Government's Covid tracker app. All of these have provided a safer environment for people to receive and deliver healthcare.

> "It's about identifying new ways of solving the problems that exist in our healthcare, creating better experiences for both patients and the Health Care Professional."

"We also ran our HIHI Spark Ignite Innovation competition during lockdown for all HSE staff who have identified solutions to problems. This is the only staff facing bottom up innovation competition for all HSE employees. Over half of those innovations were digital too. Covid-19 really forced connected health and digital solutions to the fore in healthcare."

But there aren't just benefits for the health service or businesses in the digital health sphere. There are also plenty of opportunities for digital health to create jobs and export growth.

To date HIHI have engaged with over 575 companies. Of those engagements HIHI selects solutions to address identified healthcare requirements. There are many digital health companies with a product, but only those that address a real validated problem will be successful.

"We work with companies such as Yellow Schedule which created an appointment and booking system to digitally facilitate the scheduling of appointments. Then there is Syncrophi, a digital platform to replace the paper based Early Warning Score system used to monitor patients in hospital. Through a HIHI pilot with the company we have demonstrated that a digital solution reduces error rates and improves efficiencies."

"These companies are using digital technology to deliver innovative solutions to meet the needs of healthcare. Each of these companies has begun to grow their teams, generate revenue, and ultimately look to scale to other geographical markets. This can only be a positive in the years to come", Eimear adds.

> The Irish public are mostly digitally literate too. This makes Ireland a strong model for leading in the development, testing, and deployment of innovative digital solutions for healthcare. Taking Ireland's relative size globally, it is the perfect pilot site for digital solutions.

The future of digital health

HIHI has worked across the health sector with many different Irish businesses to creatively solve problems and improve patient care.

"Ireland is ideally placed to be a world leader in the provision of total digital health solutions," says Eimear

"We have a highly networked ecosystem and the industry expertise required. This helps us to embrace the convergence between health and the Internet of Things (IoT), which is the future of healthcare globally."

Steven notes that many of the world's top medical technology companies have invested significantly in Ireland. But a number of exciting, research-based, indigenous companies are also emerging and competing internationally.

"The Irish public are mostly digitally literate too", he says, "This makes Ireland a strong model for leading in the development, testing, and deployment of innovative digital solutions for healthcare. Taking Ireland's relative size globally, it is the perfect pilot site for digital solutions."

Digital health companies going global

New technology needs to solve a real problem. Digital health drives better decision making by health care professionals by allowing them to identify risk, monitor and track disease progression. For the public it can not only support better patient adherence to care, but also promote a preventative approach to healthcare. This has proven to be particularly important for tackling heart disease and chronic conditions. With an established ecosystem of large foreign multinationals, and mobile talent already here more international investors see Irish startups as a safe bet for digital health success.

Creating the right solutions

Jim O'Donoghue, President of S3 Connected Health, speaks about how digital health solutions in medtech and pharma are empowering patient self-management and easing burdens on clinicians.

When the number of coronavirus cases started increasing back in March 2020, Dublin-based digital health company S3 Connected Health collaborated with senior respiratory consultants across Ireland to develop a new clinical support tool.

"Clinicians in hospitals urgently needed a way to cope with the crisis and better manage respiratory care delivery for affected patients," says Jim O'Donoghue, President of S3 Connected Health. "We developed a web-based application that helps support Irish healthcare professionals with triage (the process of determining the priority of patients' treatments by the severity of their condition or likelihood of recovery), monitoring, and treatment of patients in hospital, as the coronavirus pandemic continues."

The web-based application uses a Covid-19 specific risk model that was co-designed with clinicians and which acts as an early warning system to support clinicians in identifying patients that are at risk and who could be in need of ICU care.

"The solution is a CE-marked, Class I medical device, which indicates conformity with European health, safety, and environmental protection standards," says Jim, "and we developed and deployed the solution in a record 10 days; in normal circumstances it would take up to a year".

Embracing digital in pharma

Digital health solutions are becoming a vital part of today's healthcare system. Jim says, "the Covid-19 crisis has underlined the importance of embracing digital solutions to improve patient outcomes and facilitate more efficient care".

This has always been the aim of S3 Connected Health, whose solutions extend from healthcare delivery and acute patient care in the hospital to management of patients living with chronic conditions at-home.

The company partners with pharma companies to develop digital therapeutics and digital therapy management solutions for patients and clinicians in areas including neurology, immunology, respiratory, and cardiology.

"For example, we partnered with Biogen to develop a digital solution for a disease, which allows clinical teams to assess, monitor and track the disease progression," says Jim. "The solution drives better insights on the management of patients and supports specialists and care teams to make more informed decisions on the treatment of patients.

"We also developed a digital solution for the management of Multiple Sclerosis (MS) with leading pharmaceutical company Merck. This connected auto-injector and patient app supports patients with adherence and disease management, and a clinician portal provides clinicians with oversight and decision support."

Connected medical devices

S3 Connected Health also designs innovative connected medical devices, systems, and solutions for medtech clients, including implantable, wearable, and hospital-based medical devices. "For example, alongside leading health technology company Philips, we developed a wearable device for the treatment of positional sleep apnoea.

"The small palm-sized sensor device prompts patients to change position without disturbing their sleep. A companion mobile app and online portal make treatment progress easy to see; with adherence and positional sleep data accessible via a cloud-based system."

Cloud-based solutions

Affinial is the trusted cloud-based platform S3 Connected Health uses to deliver many of their digital health solutions and services around a disease, therapy, or connected medical device.

Jim says, "Using Affinial as a secure foundation, we create a range of custom-built apps, portals, and connected medical devices under our ISO13485 certified quality management system for the design and manufacture of medical devices. Creating digital health solutions using Affinial accelerates delivery, allows us to quickly scale services, and improves time to market. It's robust, secure, Health Insurance Portability and Accountability Act (HIPAA) and General Data Protection Regulation (GDPR) compliant."

> "For patients, clinicians, and healthcare providers, they need to be confident and reassured that digital health solutions meet the same exacting safety, security, and regulatory requirements as any medical device or pharmaceutical product."

Being regulatory compliant and certified is very important to the company. "We've invested heavily in the regulatory side over the past ten years and have our own in-house regulatory team," says Jim. "For patients, clinicians, and healthcare providers, they need to be confident and reassured that digital health solutions meet the same exacting safety, security, and regulatory requirements as any medical device or pharmaceutical product.

"And as European regulations switch from Medical Device Directive (MDD) to a new set of regulations under the Medical Device Regulations (MDR), there is an increasing focus on clinical evaluation and ensuring that you have the right evidence to demonstrate that your product does what it says it will do."

Building teams for success

As well as having quality and regulatory experts, S3 Connected Health's strong multidisciplinary team includes medical professionals, behavioural scientists, solution architects, user experience (UX) professionals, data scientists, engineers, and business analysts. Having such a cross-disciplinary team means they can essentially build and create the right solutions. However, another vital part of developing digital solutions is consulting with healthcare professionals and patients who will use the final products.

> Using Affinial as a secure foundation, we create a range of custom-built apps, portals, and connected medical devices under our ISO13485 certified quality management system for the design and manufacture of medical devices. Creating digital health solutions using Affinial accelerates delivery, allows us to quickly scale services, and improves time to market. It's robust, secure, Health Insurance Portability and Accountability Act (HIPAA) and General Data Protection Regulation (GDPR) compliant.

"It is always at the forefront of our mind that the end-users of these solutions are patients, healthcare professionals, or healthcare providers," explains Jim. "We typically engage with clinicians and patients in each of the solutions we develop and really try to understand the challenges that they face. The underlying disease and behavioural challenges can be similar across certain types of solutions, but the way patients experience healthcare can vary significantly. So, you really need to understand the challenges each patient cohort, clinician, or provider face."

In the case of clinical support tool for Covid-19, S3 Connected Health collaborated with Irish respiratory clinicians, including Professor Richard Costello, Senior respiratory consultant at Beaumont Hospital, as well as respiratory clinicians from the major Dublin hospitals and the HSE.

Ireland's digital health ecosystem

While S3 Connected Health also has offices in the US and Poland, Jim says there are many benefits to being headquartered in Ireland. "Ireland has developed a strong talent pool in the pharma and medtech sectors, with the right mix of small and large companies and a large availability of multi-disciplinary skills.

"This has been the result of a strong digital health ecosystem. Ireland has clinicians willing to provide their clinical insight, local partners who have specialist skills, key leaders, and research collaborators."

Jim says that the Digital Health Working Group at Ibec has been a great support for the industry. "I am Chair of the group, and it has enabled us to bring together people from the pharma sector, the medtech sector, and the digital health sector, as well as clinicians and different stakeholders to collaborate and identify challenges. The network is very valuable."

Jim continues, "We are also lucky to have great teams in Poland and in the US, where you'll find the largest pharma market in the world and many of the headquarters for large medtech companies. When we're creating our solutions, we collaborate remotely with our different centres and in today's world, this has accelerated.

"Although we have people in different locations, it's an integrated team. S3 Connected Health's client base is global and local. So, to have access to such a strong digital health ecosystem and many different stakeholders that we can easily engage with, is a unique aspect of being based in Ireland."

Getting ahead with digital

Professor Richard Costello, Consultant Physician in Respiratory Medicine at Beaumont Hospital Dublin and Professor of Medicine at the Royal College of Surgeons in Ireland, on the role digital health can play in healthcare

"Digital health is becoming huge. There's still a long way to go, but the healthcare system needs to be at the forefront in terms of digitising processes like the banking or legal industries have," says Professor Richard Costello.

"There's an amazing amount of large device manufacturers based in Ireland. But in terms of SMEs, who might develop low-cost monitoring sensors for example, we need to do more to help these companies tap into this opportunity."

Professor Costello says an advantage of digital health is to improve the patient experience. "

"Patients may feel that their doctor isn't always attentive if the healthcare professional is trying to analyse data and tapping or checking boxes on a traditional computer system. The introduction of better systems to integrate and visualise large amounts of complex data may mean a more personal patient-physician experience."

Patient-focused
Professor Costello adds digital health solutions also allow patients to share their progress and have the potential for remote monitoring, if patients want to avoid going into the hospital. This might be the case in the current Covid climate. "Patients could have their treatment and diagnosis done at home," he says.

This would also help to reduce some of the burdens in busy hospitals.

With the number of coronavirus cases increasing in March 2020, Professor Costello led a team of senior respiratory

"The introduction of better systems to integrate and visualise large amounts of complex data may mean a more personal patient-physician experience."

consultants from hospitals across the country, to develop a web-based clinical support tool called Enodatis. This venture was in partnership with S3 Connected Health.

"With no treatment for Covid, we were going to always have to rely on best supportive practice," says Professor Costello. "However, the relative benefits of the different types of supportive treatment aren't always known to all doctors.

"We realised the first thing that was going to happen was that hospitals were going to get overrun with patients, and we wouldn't always have enough specialist doctors available."

Enodatis helps specialist respiratory clinicians identify and triage the patients most in need of their attention. It also assists non-respiratory clinicians in the delivery of respiratory care with appropriate data and recommendations to support clinical decisions.

"It makes sure that everybody is communicating at a standard level and that there are no nuances in the level of support. It also means the professionals can avoid going in-and-out checking Covid patients, which can be risky."

Of the partnership with S3 Connected Health in developing the tool, Professor Costello says, "With any collaboration, there has to be a sense of common purpose and shared values. I immediately sensed with S3 Connected Health, that integrity was hugely important in our partnership."

Bringing the community together
For Ireland to be a global leader in the development and the deployment of digital health solutions, Professor Costello says it's important there's a common forum, like the Ibec Digital Health Working Group, where the digital and clinical community come together.

"The barriers for innovation and development need to disappear, for example with early startups and having a limited amount of money," says Professor Costello. "I think the industry needs to continue to reach out to the academic research community and other common channels, where you're getting showcases, fellowships and industry-sponsored internships.

"It's difficult as a clinician to do research, as there can be a lot of red tape. The clinical tool we developed with S3 Connected Health in a week might have taken two years in the absence of the heightened demand created by the Covid-19 pandemic. So, I think it's highlighted the importance of a multi-stakeholder process that needs to be introduced to support future life changing innovation."

Professor Costello adds, "One thing Covid-19 has done is made health managers around the world suddenly realise that there's not just a value, but a need, for digitalisation in healthcare."

How apps help deliver care at home

Garret Coady, CEO of BlueBridge Technologies, talks about how next-generation software can enable positive clinical outcomes.

From drug delivery devices to specialist laboratory instruments, BlueBridge Technologies provides custom medical software and technology consulting. Their clients include pharmaceutical companies and medtech businesses entering into the digital health space.

They create software for phones, the cloud, or clinical grade wearables, which can extract meaningful data about the efficacy of a medical treatment, deliver the treatment, or deliver a diagnostic.

Garret Coady says, “We work on using the phone as a diagnostic platform. We have used software to diagnose multiple sclerosis (MS) or the degree to which a patient has MS. With our custom-built hardware and firmware PC, and machine-vision technology, patients are guided through predetermined movements, captured on video, to let clinicians assess the severity of their symptoms.”

Garret says that these new types of software take the burden off health care centres, such as hospitals, as these therapies and diagnostics can be undertaken away from these settings. It can also help healthcare professionals have a more complete picture of patients’ health, as they acquire more data about the patient over a period of time rather than single data points when interacting with a healthcare professional. This helps doctors make more informed medical interventions. “We have a particular niche speciality in blending technology developments with the regulatory requirements needed in the connected health space,” says Garret. “There are three Ps of why using software can improve healthcare:

"Precision – with better technology, better diagnostics, and better therapeutics, there is more accurate diagnostics or more precise treatment. Prevention – using technology to diagnose the condition before it progresses into something that requires expensive hospital care; and Personalisation – with a data set specific to the individual, particular health care can be tailored for a patient. This way, you get less of a one-size-fits-all type health care approach, so you make things more efficient and targeted."

Developing partnerships

BlueBridge Technologies has partnered with companies such as Medtronic, Boston Scientific, Novartis, Cook Medical, Roche and West Pharma, to name a few. Companies outsource their research, development, and engineering to BlueBridge to create technologies for them.

An example of a BlueBridge innovation includes developing a medical mobile app for Medtronic that monitors and manages diabetic patients in a home care setting. A Medtronic sensor is placed on a glucometer (which measures how much glucose is in the blood) worn by the patient, and this interacts with the new mobile app to record data.

Garret says, "We engineered the app with our own developers, our own testers, and all of the documentation required. A big aspect of developing this technology is complying with the regulations in the medtech industry. There are design controls, risk management, and verifications of specific parts, and these activities are also outsourced to us by companies. Our systems and procedures are fully vetted to make sure they're compliant with the law, but also that they comply with the specific standards of Medtronic, Novartis, Boston Scientific and any company we engineer for, so that we operate as an extension to the internal development departments within these companies.

In order to get to the market, a high bar is set for demonstrating safety, efficacy, and clinical benefits for medtech under current regulations. Software as a medical device is a new category of software and the United States and the European Union regulate these. They place obligations on manufacturers to ensure devices are safe, fit for their intended purpose. And ensure regulatory compliance in protecting user data.

"The International Medical Device Regulators Forum is a really good global regulatory regime and gives a lot of guidance in this area. The software is closely monitored all the time to ensure it meets regulations."

Solving problems

Garret says that when creating software, it cannot just be technology for technology's sake; it has to solve a real problem. It is critical to consult with healthcare professionals and patients before and during developing digital therapeutics or "digiceuticals" products. He adds that if not consulted, the product won't be successful.

"The technology has to not only work for the patient and the doctor, but it also has to work for the hospitals and the insurance companies. These are the major stakeholders who all have to see value in what's being delivered."

Whether that is digitally measuring the medication adherence of patients, or for enabling virtual patient care outside the hospital. Garret notes that the acceptance of this type of technology has been advancing slowly for the past decade, but the Covid-19 pandemic has helped speed up its adoption.

"A lot of the barriers to remote healthcare via technology have fallen because of Covid-19. Suddenly, people are seeing the benefits of using virtual patient/doctor contact. So, the pandemic has actually progressed and accelerated things in this domain."

Market access

Along with Ireland, Bluebridge Technologies has a big presence in the US, Switzerland, and Germany. Garret remarks that doing these types of digital health activities in Ireland, allows them access to a strong IT sector, medtech centre and medical device sector. This is a real advantage to other markets.

"Attracting and developing talent is essential. Ireland has a workforce, with the skilled graduates that we, as a company and part of an industry, need. The availability of talent from the manufacturing, medtech, pharma, and technology sectors are all required on the frontline to create these solutions. Ibec is great at identifying these in-demand skillsets. They find out what the real needs of the industry are and fuel the ecosystem in digital health while blending the cultures of the different segments."

Garret adds, "That blend of cultures is why we are able to deliver on the promise of digital health. That's what makes it such a fascinating area to work in and that's what keeps us innovating for the future."

Navigating the regulatory pathway

Dr Lorraine Nolan, CEO of the Health Products Regulatory Authority, shares her thoughts on the importance of regulating digital health products and services

"The Health Products Regulatory Authority's (HPRA) role is to protect and enhance the health of patients and the public," says Dr. Lorraine Nolan, who has over 18 years' experience working within the biopharma sector. "Everything we do is built on this underlying principle."

As a state agency, the HPRA is responsible for regulating a range of health products in Ireland. The agency also participates at the working-level through the European Medicines Agency (EMA) and in the medical device space, through the European Commission.

It is vital to regulate digital health devices and solutions, to ensure they are as safe as possible and fit for purpose. "The core principles of regulation that apply to all products, apply also to digital health," says Lorraine.

She explains, "This involves having an appropriate design plan and vision for the product or solution, and carrying out a performance and clinical evaluation of the product. Then, ensuring that the manufacturing process of the product has been validated and this stays in a state of control."

"Once the product goes into the marketplace, traceability is required throughout the distribution chain. There needs to be an appropriate system in place for monitoring the performance of the products out in the marketplace." These traditional requirements, she noted, are more challenging to apply to digital health products.

Understanding the requirements

However, Lorraine says there is one difference to regulating digital health

products and that is “a call to be more adaptive and agile, in terms of how we work as regulators and the kind of information that we are evaluating and assessing”. This is due in part to the fact that these are cutting-edge, innovative technologies.

In recent years, the HPRA has established an Innovation Office, to provide regulatory support and advice to those developing innovative devices and solutions, from individuals to small and medium-sized enterprises.

“The aim is to help ensure that innovators have an understanding of the regulatory requirements that apply to a new product or device at an early stage of development. This can help to avoid potential regulatory issues at a later stage and ultimately lead to new products being developed and receiving regulatory approval quicker,” says Lorraine.

“We have also commenced an outreach programme with higher education institutes and research centres, to further support innovation across the industry.”

What data means for regulations

Big data – captured across various devices such as wearables, as well as electronic health records – is hugely important in the healthcare sector today. However, this rapidly changing real-world data landscape means regulators need to evolve and change the way they access and manage data, to keep up.

“The EMA, in conjunction with the Heads of Medicines Agency (HMA), convened a big data taskforce, which has a number of recommendations to support the regulatory network and its evaluation for digital health products into the future. This involves looking at the skillsets agencies may need and how we can upskill on an individual level, as well as on a network basis.

“Attracting skillsets and talent has been a huge focus for us as an organisation and how we can further expand and develop in this area.”

“The aim is to help ensure that innovators have an understanding of the regulatory requirements that apply to a new product or device at an early stage of development. This can help to avoid potential regulatory issues at a later stage and ultimately lead to new products being developed and receiving regulatory approval quicker.”

How digital health is regulated

Lorraine advises that whether a digital health product is classified as a medical device depends upon whether it is intended for treatment or diagnosis. “And then there are additional requirements on top of that for software”.

“There is a segregation between some apps on mobile phones that simply gather health information, for example on how many steps you have taken today. These don’t necessarily qualify as a medical device.”

Lorraine adds the EU Commission is in the process of implementing a new framework for medical devices, the Medical Devices Regulation, which is scheduled for full application in May 2021. The new regulations will create a robust regulatory framework, recognised internationally, that improves clinical safety and creates fair market access for manufacturers and healthcare professionals.

“Under the new framework, software as a medical device will be up-classified and require certification by notified bodies,” says Dr Nolan.

Engaging the ecosystem with a vision

For any company developing digital health products or services, Lorraine advises having a design-and-development strategy, which is aligned to the regulatory process during every stage in the product development cycle. “This will enable early identification of the applicable regulatory requirements for the product, and facilitate sufficient planning.

“Generating and appropriately evaluating clinical data to demonstrate the clinical performance of the device and its safety is important too. As an organisation, we're very happy to engage with product developers and manufacturers to discuss the regulatory system and the requirements, and support innovators.”

Lorraine adds that Ireland is positioned very well in terms of innovation, “We have a very vibrant medical device and technology sector. It’s all about building proper ecosystems and ensuring that we interact with each other as much as possible across those ecosystems, so that we really can bring forward our ideas.”

At the heart of digital health innovation

Conor Hanley, President and CEO of FIRE1, speaks about developing a new device that will help remotely monitor people prone to heart disease, and why Ireland was chosen as the location to launch the US-founded business.

"Heart failure, which is a declining efficiency of the heart, is a very serious and costly condition," says Conor Hanley, President and CEO of FIRE1, a Dublin-based company focused on developing world-class innovation within the connected medical devices field, including a novel remote heart monitoring device.

"In the US, heart failure affects 6.5 million adults and there are one million hospitalisations a year, at a cost of an estimated $30 billion. Lifetime risk of heart failure is estimated to be one in five at 40 years of age."

While in Ireland, heart failure affects around 90,000 people, with the over 50s most at risk, though younger people can develop it.

Conor says, "Heart failure is causing a big strain on Ireland, as well as globally, and there is more pressure on hospitals, especially in the current climate. People are living longer with chronic diseases, so there's a critical need in how care is delivered. But it's being completely amplified by the current context of Covid-19. I think that has really catalysed the market need for digital health products, and the interest of patients taking more power to control their health too."

> There are certain building blocks involving the integration of information that needs to be in place. One such building block would be that whoever is collecting data would have the knowledge and training to allow them to input the data in a way that reaches a certain minimum standard across healthcare.

Improving lives

According to Conor, heart failure is challenging to manage in hospitals today.

“At FIRE1, we are focused on improving the lives of patients with heart failure, while lowering overall healthcare costs and reducing the need for hospitalisation. We are currently in the process of developing a novel remote heart monitoring device. This device will aim to decrease the emergency admissions that overload the hospital, by attempting to monitor heart disease earlier in the home.”

FIRE1, which has over 30 staff, was originally founded in California, as part of The Foundry, a US-based incubator for medtech startups. The Foundry headquartered FIRE1 in Ireland over five years ago, and it became the first company the incubator founded that was based outside of the US.

“There are a number of reasons The Foundry chose Ireland as a location to launch FIRE1,” says Conor. “Europe has historically been a great location for medical device innovation, and Ireland is well placed to be a world leader in the provision of connected health solutions.

“We have a unique ecosystem with the breadth of skills and the combination of the reach and rigour of the larger companies and the entrepreneurship of our smaller growing companies. And with the presence of the medtech, ICT (Information and Communications Technology), and pharma sectors, there’s a great opportunity for innovation and digital transformation.

“Ireland’s ecosystem is extremely dynamic. Having an environment of people with great experience, who have an extensive knowledge of the industry and great capability, means we can lead globally.”

Invested in the cause

Back in 2018, FIRE1 raised €40 million in funding to develop its remote monitoring product. This funding includes backing from specialised EU healthcare investors Gilde Healthcare and GIMV, which have made their first investments into the Irish market through FIRE1.

“There has been great confidence from our investors, who are some of the largest investors in Europe and the US,” says Conor. “For many of these investors, it's their first investment in Ireland. There’s investment from leading venture capitalist firms Lightstone Ventures and New Enterprise Associates, as well as from Medtronic, which is the global leader in medical technology. This has enabled us to accelerate our progress and deliver on our commitment to helping patients with heart failure.”

Conor, who was previously Chair of the Irish Medtech Association, says that the organisation has also been a huge support. “Ibec not only has an effective voice in policy for the industry, but also provides a great forum for conversation and in allowing the ecosystem to learn. I have attended many of the digital health programmes. Here, both large and small companies can talk about the challenges and opportunities around innovation and the need for digital health.

"Ibec brings the industry together in Ireland with global experts and companies, which has really helped structure conversations about where the industry is going. I, and FIRE1, have certainly got a great benefit from being a member of Ibec."

Commitment to patients

Currently, the team at FIRE1 is continuing to develop the remote monitor, which will eventually be available to global markets. The R&D has involved collaborating with healthcare professionals and consulting patients.

"We spent a lot of time with both patients and physicians," says Conor. "This was a critical aspect of our whole design thinking methodology – to get their thoughts and understand their needs.

"We work with doctors in Europe and the US, but we have also done a lot of work with Irish physicians. They are very well-trained and really have been a value enhancer for helping develop what we are doing."

Conor adds, "We have an amazing team in FIRE1, made up of those with experience in both startups and large companies. This is essential in a regulated space. I am motivated by what the industry is trying to do; namely helping people to live better and reduce the suffering of disease.

"We are essentially trying to bring the expertise found in the hospital into the home. This, in return, will both help the patient have the right care at the right time, and reduce the burden on the health system."

> "There are certain building blocks involving the integration of information that needs to be in place. One such building block would be that whoever is collecting data would have the knowledge and training to allow them to input the data in a way that reaches a certain minimum standard across healthcare."

Virtual care for heart failure

Professor Ken McDonald, Consultant Cardiologist and Medical Director of the Heart Failure Unit at St Vincent's University Hospital, talks about using digital health to combat the rise of heart failure in Ireland

"People are living far longer into old age, which is one of the reasons heart disease is at the very top in causes of death," says Ken McDonald who has been a cardiologist for nearly 40 years. "Increasing obesity and increasing diabetes diagnoses, also continue to drive heart disease rates up."

Heart disease is the most common cause of death in Ireland today. According to the Irish Heart Foundation approximately 10,000 people die each year from cardiovascular disease – including coronary heart disease, stroke and other circulatory diseases.

For this reason, Ken developed the Heart Failure Unit at St Vincent's University Hospital, Dublin, on his return after working as a consultant cardiologist in the USA in 2000. As medical director, he has overseen the growth of the unit into an internationally recognised clinical service and heart failure research centre.

"I thought it was an area which required much more attention," says Ken. "St Vincent's and St Michael's hospitals were very willing to support the creation of the unit. So, it became a great opportunity to start looking at ways to provide better heart failure care."

Virtual care

Ken says that digital health will play a major role in helping patients with heart failure, and in other areas of medicine as well.

"While face-to-face healthcare is still necessary, I think several health encounters could be changed to an eHealth or virtual platform, this will have important allied benefits, reducing the need to travel to hospital or clinic settings.

"While face-to-face healthcare is still necessary, I think several health encounters could be changed to an eHealth or virtual platform, this will have important allied benefits, reducing the need to travel to hospital or clinic settings."

One highly successful example of virtual care developed by the Heart Failure Unit in 2015 is their Virtual Consultation. This involves a virtual heart failure clinic, where GPs can discuss their patients with a hospital-based cardiology consultant via video link-up. The virtual clinic now has over 150 GPs using the service.

"The GP can benefit from this real-time online consultation and decide on different medication, continued monitoring or perhaps an appointment at a clinic. And the patient gets the benefit of the consultation without needing to travel to a hospital to see the specialist.

"These patient cases would ordinarily be referred into our outpatient waiting list, so not only is it better for the patient and the doctor, but it reduces the pressure on the outpatient system making it more available for those that need face to face appointments.. And with more funds, the service could be extended to other specialities too, not just cardiology."

Preventing heart failure

In addition to the clinical services the Heart Failure Unit provides to over 4,000 patients, Ken also leads an active research programme.

One of their major successes has been the development of the Stop Heart Failure (STOPHF) initiative which Ken says is regarded as "an international first". This programme offers screening to prevent heart failure. The programme uses a blood test to measure a protein called a natriuretic peptide, which is released by the heart when it is under stress. This is an early warning sign of heart failure.

Ken says, "Preventing a disease is always a better alternative than waiting for it to develop. Another theme of our research has been to develop new ways of delivering care. Our Virtual Consultation is one aspect of that.

"This has led us to link-up with digital health and medtech companies. They have the expertise in devices, and we have the expertise in knowing what the patient needs. We try to leverage IT to make sure that it's user-friendly for all generations while delivering what it needs." This requires communication between physicians and people with expertise in e-health to deliver the best package.

With all of these big developments and expertise, does Ken think Ireland can lead the way in digital health solutions?

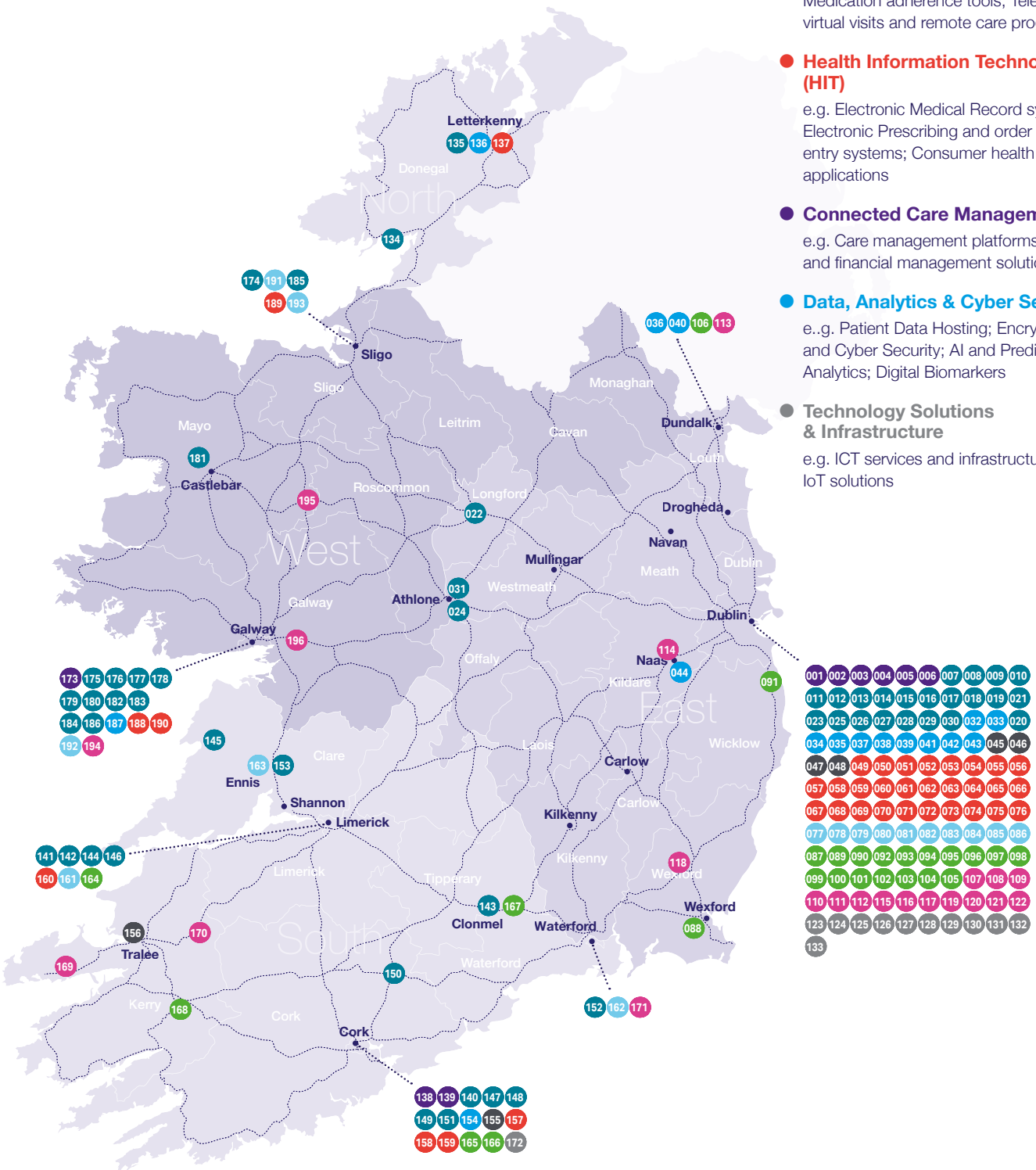
"There are plenty of opportunities for growth, especially if we keep the focus on e-health. That is a critical aspect of the way forward in all healthcare delivery. In this respect, Ireland can do very well."

Ireland's Digital Health Ecosystem

For the purposes of this map we have partitioned the ecosystem into nine specific categories, identifying key areas of how Digital Health addresses global challenges. These categories broadly reflect solution types to offer a consistent view of digital health activity in Ireland.

We classify companies within the ecosystem as follows:

- **Connected Medical Devices**
  e.g. Wearable & Wireless Medical Devices; Software driven diagnostic products; Therapy delivery devices; Biometric Sensors
- **Digital Therapeutics**
  Software driven therapeutics
- **Mobile Health (mHealth) & Wellness**
  e.g. Wellness, fitness trackers, nutrition & lifestyle apps; Virtual health assistants; Healthcare Coaching
- **Personalised Healthcare**
  e.g. Precision Medicine; Personalised support, symptom management and interventions; Clinical decision support solutions
- **Remote Patient Monitoring & Telehealth**
  Remote patient monitoring solutions; Medication adherence tools; Telemedicine virtual visits and remote care programmes
- **Health Information Technology (HIT)**
  e.g. Electronic Medical Record systems; Electronic Prescribing and order entry systems; Consumer health IT applications
- **Connected Care Management**
  e.g. Care management platforms, staffing, and financial management solutions
- **Data, Analytics & Cyber Security**
  e..g. Patient Data Hosting; Encryption and Cyber Security; AI and Predictive Analytics; Digital Biomarkers
- **Technology Solutions & Infrastructure**
  e.g. ICT services and infrastructure; IoT solutions



East Region

Connected Care Management

001 Eirmed
002 Grapevine Solutions Ltd
003 MEG Support Tools
004 NurseBuddy Care Software
005 Oneview Healthcare
006 Ranesys Ltd

Connected Medical Devices

007 BD Medical
008 BlueBridge Technologies Ltd
009 BrainWaveBank
010 Comtrade Digital Services
011 Cortex Cognition
012 Design Partners
013 Dolmen Design and Innovation
014 FIRE1
015 Frontend.com
016 i360 Medical
017 Jabil Healthcare
018 Kinesis Health Technologies
019 Lifelines Neuro
020 Neuromod
021 OneProjects
022 Purpledecks
023 Realtime Technologies Ltd
024 Renew Health
025 ResMed
026 Roche Diagnostics
027 Shimmer Research Ltd
028 Siemens Healthineers
029 Tapadoo
030 West Pharmaceuticals
031 ZAC

Data, Analytics & Cyber Security

032 ACE Health
033 Akkure
034 Clindox
035 Clinical Trial EndPoint (CTEP) Ltd
036 Diaceutics
037 IBM Watson Health
038 ICON Clinical Research
039 IQVIA
040 Nova Leah
041 Novartis
042 NSilico
043 Nuritas
044 Odyssey VC

Digital Therapeutics

045 Beats Therapeutics
046 Cortechs
047 patientMpower Ltd
048 SilverCloud Health

Health Information Technology (HIT)

049 Amazon Web Services (AWS)
050 ArisGlobal Ltd
051 CareWorks, an Advanced company
052 Cerner
053 Clanwilliam Health
054 Clintech Health Care
055 Cognizant
056 dabl Limited
057 DMF Systems
058 Full Health Medical
059 GE Healthcare
060 HP Technology Ireland Limited
061 IMS MAXIMS
062 Jinga Life
063 Kainos
064 Kitman Labs
065 MANITeX Limited
066 Medxnote
067 Ocuco Ltd
068 OpenApp
069 Pharmapod Ltd
070 Swiftqueue Technologies Ltd
071 Teckro
072 Two-Ten Health Limited
073 Valentia Technologies
074 Version 1
075 Vitro Software
076 Zendra Health

Mobile Health (mHealth) & Wellness

077 3d4medical
078 Coroflo
079 Fatigue Friend
080 Fitbit
081 Hibernian Health
082 Incaplex
083 LumaFit
084 Nutritics
085 TickerFit
086 Zevo Health

Personalised Healthcare

087 Actualise
088 Dynomed
089 Empeal Health
090 Genebox
091 Grace App Communication
092 HealthBeacon
093 HealthXL
094 Helsinn
095 Innovation Zed
096 InsulCheck
097 Kids Speech Labs
098 Mallinckrodt
099 MyPatientSpace Limited
100 Oncomark
101 Pfizer Healthcare Ireland
102 Philips Healthcare
103 S3 Connected Health
104 Sanofi
105 SelfSense Technologies
106 Tapa Healthcare DAC

Remote Patient Monitoring & Telehealth

107 3rd Pillar Clinical
108 Captec - Computer Applied Techniques Ltd.
109 CareZapp
110 Firmwave, a Taoglas Company
111 Fit for Life
112 Global Diagnostics Ireland
113 Isaac
114 Nua Solutions
115 OralEye
116 Think Biosolution
117 Toothpic
118 Tunstall Emergency Response Ltd
119 videoDoc Healthcare
120 Vu2Vu
121 Webdoctor.ie
122 Wellola

Technology Solutions & Infrastructure

123 Asavie
124 Ericsson
125 Fujitsu Ireland
126 Google
127 IBM Ireland
128 Intel
129 Microsoft
130 Oracle
131 SoftPotential
132 Taoglas
133 Vodafone Ireland Ltd

North Region

Connected Medical Devices

134 Abbott Diabetes Care
135 Phillips-Medisize

Data, Analytics & Cyber Security

136 Optum, a UnitedHealth Group company

Health Information Technology (HIT)

137 Health Union Technologies

South Region

Connected Care Management

138 Carefolk
139 Epic Solutions Ltd

Connected Medical Devices

140 AbbVie
141 Analog Devices
142 BD Medical
143 Boston Scientific
144 Cook medical
145 Evolve Technologies
146 Flemming Medical Ltd
147 Intelligent Implants
148 PMD Solutions
149 Radisens Diagnostics
150 Sanmina
151 Stryker
152 TEVA Ireland
153 Vitalograph

Data, Analytics & Cyber Security

154 Independent Data Management Ltd

Digital Therapeutics

155 Redicare
156 Salaso Health Solutions Limited

Health Information Technology (HIT)

157 GE Healthcare
158 KM Medical Software Ltd.
159 Lincor Solutions
160 Tracworx

Mobile Health (mHealth) & Wellness

161 Doctot
162 NearForm
163 Penny Medical

Personalised Healthcare

164 Clinical Support Information Systems Ltd
165 Eli Lilly Kinsale Limited
166 GlaxoSmithKline
167 MSD Ireland
168 ONCOassist

Remote Patient Monitoring & Telehealth

169 3G Doctor Ltd
170 ADA Security Systems
171 RelateCare

Technology Solutions & Infrastructure

172 Apple

West Region

Connected Care Management

173 OneTouch Health

Connected Medical Devices

174 AbbVie
175 Aerogen
176 Atlantic Therapeutics
177 Bio-Medical Research Ltd
178 Creganna Medical, part of TE Connectivity
179 Enterasense Ltd
180 Feeltect
181 Fort Wayne Metals Ireland Ltd.
182 Johnson & Johnson Cerenovus
183 Kite Medical
184 Medtronic
185 Phillips-Medisize
186 Synecco

Data, Analytics & Cyber Security

187 Orreco

Health Information Technology (HIT)

188 Avaya
189 Socrates Healthcare
190 Syncrophi Systems Ltd

Mobile Health (mHealth) & Wellness

191 Kudos Health
192 Rockfield Medical Devices
193 Sound Relief by Lios

Remote Patient Monitoring & Telehealth

194 Bluedrop Medical
195 Homecare Medical
196 Independent Living Ireland

Companies may be active across multiple categories. However, for the purposes of the map a primary category was selected.

Disclaimer:

While the coordinators have made every effort to ensure that this information is accurate, we do apologise for any inconsistencies. Stakeholders who wish to make amendments or be added to this list, please contact Irish Medtech Association on 01 6051537 or info@irishmedtechassoc.ie. It is anticipated that updates will be supported on an ongoing basis at the discretion of Irish Medtech. Date of Publication: November 2020. E&OE.

Digital Health Ecosystem Supports

Research Centres, Start-up Accelerators, Incubators and more

Name	Area of focus
ADAPT	Research Centre for Digital Media Technology
AMBER	Research Centre for Advanced Materials and Bioengineering Research
APC	Research Centre for APC Microbiome Ireland
BioInnovate Ireland	Enabling Medical Technology Innovation
CeADAR	The Centre for Applied Data Analytics Research
Connect	Research Centre for Future Networks & Communications
CRCI	Health Research Board Clinical Research Coordination Ireland
Cúram	Research Centre for Medical Devices
EIT Health	Knowledge and innovation community
FutureNeuro	Research Centre for Chronic and Rare Neurological Diseases
Health Innovation Hub Ireland	Drives collaboration between health services and enterprise
ICHEC	The Irish Centre for High-End Computing
INFANT	Irish Centre for Foetal and Neonatal Translational Research
Insight	Research Centre for Data Analytics
IPIC	Research Centre for Photonics Technologies
Lero, the Irish Software Research Centre	Research Centre for Software
NetwellCASALA	Research Centre for enhancing longer living in smarter places
NIBRT	National Institute for Bioprocessing Research and Training
Nova UCD	Centre for New Ventures and Entrepreneurs
SSPC	Research Centre for Pharmaceuticals
Systems Biology Ireland (SBI)	Research Centre investigating new therapeutic approaches to disease, with a focus on cancer at a systems level.
Tangent, Trinity's Ideas Workspace	Digital Health Validator Programme
The Digital Hub	Enterprise cluster for growing technology companies
Tyndall National Institute	Research Centre in Integrated ICT Hardware and Systems

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How medtech is connecting devices and people

The medtech industry has evolved from developing medical technology products, to broader solutions. Ireland offers FDI multinationals access to top talent and room to grow with many leading companies having multiple sites across the country. Not only are these sites connected, so are the latest medical devices, these offer healthcare professionals remote updates on how the devices are performing and how patient are doing. Across Europe many hospitals are experiencing high demands for care, but digital health can mitigate shortages by creating efficiencies. Europe is the second largest medtech market in the world with a strong reputation for regulatory affairs but, more needs to be done to make data interoperable and help disruptive innovation get reimbursed across health systems.

Digital monitoring of patient care

Conor Russell, Vice President of Operations at Boston Scientific, talks about the latest developments in remote monitoring and the importance of digital health activities in Ireland.

"Developing the right patient monitoring tools to support our implantable medical devices ensures that not only can we continue to deliver the best patient outcomes, but that we also provide the most effective way to communicate and follow up with our patients after surgery. Some of our devices deliver therapy for many years after implant, so streamlining the follow up process is essential to reducing any overall burden on the healthcare system and helping patients manage their condition" says Conor Russell, who is based at Boston Scientific's Clonmel facility in Co Tipperary

Boston Scientific is a global leader in the development of medical devices for cardiology, endoscopy, urology and a range of debilitating conditions such as chronic pain, Parkinson's Disease, digestive system cancers, vascular diseases and heart rhythm disorders The company employ around 6,000 employees at their Clonmel, Cork and Galway sites, and employ over 36,000 people worldwide.

"Here in Clonmel we develop and manufacture long term implantable electronic devices such as implantable cardiac pacemakers and defibrillators, as well as neurostimulators such as spinal cord and deep brain stimulators".

Conor says they are increasingly turning to utilising digital and connected health solutions to support both patients and physicians.

One of the key cardiac devices produced by Boston Scientific is the cardiac implantable cardioverter defibrillator (ICD). This device monitors and treats dangerously fast ventricular heart rhythms. When the ICD senses a dangerously high heart rate, it sends a high voltage electrical shock to the heart which stops the arrythmia and allows the heart to resume beating normally again.

"Our ICDs are a life-saving technology that can last up to 10 years and as such it's incredibly important for our patients and their physicians that we can remotely monitor these devices and that we can continuously review the critical patient data that they generate. The majority of our cardiac devices are automatically connected to the LATITUDE NXT Remote Patient Management System. This is comprised of a communicator and secure website, as well as an optional weight scale and blood pressure monitor, to help physicians monitor patients' cardiac device remotely. Not only is this beneficial for physicians, but very much so for patients as well. Physicians can remotely check in on the patient at any time and get notified of any patient episodes that may have occurred. One patient even recently described having remote monitoring as if they were 'taking their doctor to bed at night'!

"Using our HeartLogic algorithm, our R&D team have also devised a way to use multiple sensors on our devices to track physiological trends and combine them using an algorithm to predict the onset of an acute heart failure episode up to 34 days in advance. When it predicts an event, it sends an automatic alert sent to their doctor. and enables the doctor to provide early intervention advice to patients and avoid expensive trips to the hospital that often occurs with these acute events.

Boston Scientific spinal cord stimulation devices are also manufactured at this facility. These are implanted devices for patients who suffer from conditions such as chronic back pain. Prior to getting a device, many of these patients have tried other treatments, such as prescription medications or back surgeries, which have been unsuccessful. The implanted device generates an electrical pulse to stimulate the spinal cord and can significantly reduce the patient's pain, helping them resume daily activities and improving quality of life.

As pain is unique to the individual and even for the same person, their pain will often move around, there is ever growing need to be able to personalise stimulation therapy for each patient. By connecting the device wirelessly to external control devices, patients can change the stimulation mode and the intensity, thereby giving them more control to choose the therapy that works best for them at that time.

"Developing the right patient monitoring tools to support our implantable medical devices ensures that not only can we continue to deliver the best patient outcomes, but that we also provide the most effective way to communicate and follow up with our patients after surgery. Some of our devices deliver therapy for many years after implant, so streamlining the follow up process is essential to reducing any overall burden on the healthcare system and helping patients manage their condition."

> We are a leader in long term electronic implantable medical devices and it's critical that we continue to build on that. Our ability to attract and retain the best talent in the industry is essential to our long term success and luckily here in Ireland we are have access to a great pipeline of STEM talent from our third level institutions and research institutions.

Creating connected devices

Boston Scientific supplies these devices and other devices from their Clonmel facility which employs over 1,000 people. The products manufactured in Clonmel are then distributed all over the world.

Conor says "Over the past 20 years, we have built a highly specialised team that combine software, firmware and electronic skillsets with the more traditional process, automation and science-based skillsets that we usually associate with medical devices. We are a leader in long term electronic implantable medical devices and it's critical that we continue to build on that. Our ability to attract and retain the best talent in the industry is essential to our long term success and luckily here in Ireland we are have access to a great pipeline of STEM talent from our third level institutions and research institutions."

Digital health in Ireland

Conor says that even though Ireland is a small country, it is uniquely positioned to take advantage of the transformation that will take place in healthcare with the adoption of new digital health solutions. The adoption of these tools will be fuelled by increasing patient engagement, increasing regulation complexity and an ever greater need to keep healthcare costs under control.

With 9 of the world's top 10 medtech companies and 9 of the top 10 ICT technology companies in the world with locations in Ireland, there is a unique concentration of industry, skills and ambition to be a leading global hub for future digital health solutions.

How digital is reimagining medicine

The pharmaceutical industry in Ireland is reimagining medicine with digital health. Digital health is not only leading to a better understanding of how medicines are developed and used. Data is helping gather insights from clinical trials to develop better drugs, faster, while ensuring that patients better understand their medication and can adhere to it more easily. The availability of a highly educated workforce as well as the presence of leading companies from key sectors such as medtech and tech makes Ireland a location of choice for pharmaceutical businesses developing digital health.

Reimagining pharma with digital transformation

Lorcan Walsh, Director of Data Science and ad interim Digital Solution Director for Digital Endpoints at the Novartis Global Service Centre in Dublin, and Ashwini Mathur, Solution Lead and Head of Data Science and Artificial Intelligence Hub Dublin at Novartis Ireland, speak about how digital technologies and innovative sciences can improve and extend people's lives.

Leading global medicines company Novartis has a mission to use new digital technologies and innovative sciences, to create transformative medicines that address the evolving needs of society.

The company's products – which includes a range of medicines and drugs in areas such as cardiometabolic, immunology and dermatology, neuroscience, ophthalmology, respiratory, oncology and new cell-and-gene therapies – are available in more than 180 countries, reaching nearly one billion people in 2018.

Lorcan Walsh says, "Data and digital are key enablers of Novartis' ambitious transformation to become the leading medicines company powered by data science and digital technologies."

"We are a data rich and data-driven business, for example, over the past two decades we've collected 2 million patient-years of data from our clinical trials. Beyond clinical trials and when patients are using our therapies in clinical practice, we continue to monitor for effectiveness and safety."

However, with new scientific advances in recent years, the ability to analyse huge amounts of data in new ways has become significant, offering new opportunities to improve human health. Lorcan says this is why the company is aiming to "reimagine medicine" and adapt the way data is collected and interpreted.

"To reimagine medicine, we need to reimagine the way we work. This involves combining digital and data, so that we can measure patients better within our clinical trials, reduce the medicine development timeline, and get better therapies to patients faster.

"Digital can also help us collect novel insights in patients' lives to build a better chain of evidence to advance our therapies, reduce patient burden and shorten trial durations. For example, currently within our trials, we collect data including different devices, such as X-rays, biosamples, and information from patients themselves encompassing how a patient feels, functions, or survives. Digital solutions, such as wearable sensors or at-home surveys, are showing more and more potential to gather more sensitive measures and can be gathered at home potentially reducing the need for patients to visit the clinic."

Engaging with patients in the community

This move towards digital can also address the sustainability challenge with structural reforms in healthcare. Technologies can be used to manage patients in their community, rather than in hospital. Lorcan says digital innovation can help healthcare professionals (HCPs) to better engage with the patient and ensure medication is being taken at the right time.

"A patient may have to take 4-5 medications at different times of the day and that can be difficult and confusing. So, we've been developing apps to improve medication adherence.

Partnership with various companies is important in the process of bringing a new medicine to market. Ashwini Mathur says, "We develop medications for all stages of the patient care continuum. However, as we are not a medical device company, we focus on how we can partner with other players in the ecosystem, to be able to get medications to patients quickly.

"So when a device is being used by a patient, we look at analysing the data from the device, to create a medication which could be useful for patients."

Partnering with tech giants

As part of rreimagining treatment discovery and development, Novartis recently announced a five-year partnership with software giant Microsoft.

"We are exploring how Microsoft's artificial intelligence (AI) technology can help Novartis interpret huge amounts of data and accelerate research into new treatments. These include cancer and age-related macular degeneration," says Ashwini.

"Previously, Novartis and Microsoft would do things independently of each other and then interact with each other at a stage when it seemed appropriate. But now, we are tackling problems together right from the beginning, and then actually creating a solution and implementing it together."

Ashwini adds, "In this collaboration, we work through virtual teams globally. Novartis has set up teams in Cambridge, US and at the Novartis Global Service Centre in Dublin, where we are based. Microsoft has teams in Seattle and Cambridge, UK."

Ireland's attraction

The Novartis Global Service Centre in Dublin, which is one of five around the world, has scaled rapidly since it was first established in Ireland in 2013. Ashwini says there are many advantages to being located in Ireland. "Ireland has the same time zone as the headquarters in Basel, but Ireland is also accessible to Asia and the US.

"To reimagine medicine, we need to reimagine the way we work. This involves combining digital and data, so that we can measure patients better within our clinical trials, reduce the medicine development timeline, and get better therapies to patients faster."

"Ireland also has the advantage of being an English-speaking country too. And a benefit is the digital health infrastructure that exists in Ireland. This goes for both the academic setting and the corporate setting. There are niche companies doing cutting-edge digital health work. Then, there is very significant research happening within academia, which we, at Novartis, engage with."

Lorcan adds, "We have a highly skilled and educated workforce around digital health. 20% of the people on-site in our Dublin centre have PhDs and two-thirds have a Masters."

Tackling Covid-19

During the recent pandemic, Novartis in Dublin and Cork played a key role, donating funding for Personal Protective Equipment (PPE), contributing to research efforts, and keeping up with the medication supply that was needed.

With one of Novartis' main aims being to better manage patients at home, Lorcan says the recent pandemic has, in fact, brought about opportunities for digital health. "Covid-19 has created a strong need to avoid face-to-face interactions. For example, how often will we now meet our GPs face to face? Videoconferencing is going to start playing a greater and greater role.

"During lockdown, we've also been very active in creating new models to engage and upskill HCPs in our novel medications through virtual means."

Don't just take Lorcan and Ashwini's word for it, the statistics say it all too – in recent Novartis research, 86% of tech professionals agree the healthcare and pharma industry's 'digital moment' has arrived.

"Ireland also has the advantage of being an English-speaking country too. And a benefit is the digital health infrastructure that exists in Ireland. This goes for both the academic setting and the corporate setting. There are niche companies doing cutting-edge digital health work. Then, there is very significant research happening within academia, which we, at Novartis, engage with."

How technology is enhancing experts

The tech industry is transforming health and enhancing expert driven results. Computers and artificial intelligence are making an impact from digital surgery which offers greater ability to spot subtle problems or changes than the human eye alone, to accelerating drug discovery with analysis of data. But technology alone cannot revolutionise healthcare, innovation is underscored by partnership with research centres and clinicians. That why global tech businesses are growing sites in Ireland to develop digital health solutions and tap into international markets

Health in the future

Pól Mac Aonghusa, Senior Research Manager at IBM Ireland, speaks about the importance digital health can have on making the right health decisions in the future, both for the patient and the healthcare professional.

"80% of the time, we don't really think about our health," says Pól Mac Aonghusa, who works at the Irish facility of US company International Business Machines (IBM) Corporation. "It's only when a negative incident happens, that healthcare suddenly becomes vital. For example, we might think about short-term fixes, like fad diets, losing weight after Christmas or needing to eat healthy. But we need to think about healthcare seriously in the long-term.

"A chronic condition like obesity doesn't happen because of a weekend binge on junk food. It develops over several years, as can other chronic conditions such as congestive heart disease and chronic obstructive pulmonary disease. So where we need to help is not just when we feel unwell – it's also helping us to adopt behaviours to delay the onset of chronic conditions and to self-manage to help lessen impact on our daily lives, for as long as possible."

This is where Pól sees the opportunity for digital health, "It's about managing our resources in the healthcare system and making people more aware of the impact their current decisions can have on their future health."

> A chronic condition like obesity doesn't happen because of a weekend binge on junk food. It develops over several years, as can other chronic conditions such as congestive heart disease and chronic obstructive pulmonary disease. So where we need to help is not just when we feel unwell – it's also helping us to adopt behaviours to delay the onset of chronic conditions and to self-manage to help lessen impact on our daily lives, for as long as possible.

Delivery of care

IBM is one of the largest technology and consulting companies in the world, with its research lab setting-up in Ireland in 2010. Pol's research involves looking at how technology can make the delivery of care to people better, and help to augment the highly skilled people that work in the medical fields.

He's currently involved in two major joint research projects – Ireland's first Digital Surgery Unit at the Mater Hospital, which is funded by the Government, and ProACT, which is funded by Horizon 2020.

"The Digital Surgery Unit is led by Professor Ronan Cahill, Director at the Precision Surgery Centre, UCD and Digital Surgery Unit Mater Misericordiae University Hospital, and is a partnership with IBM Research and Royal College of Surgeons in Ireland (RCSI)," explains Pol. "The Unit is focused on how new techniques and technologies, such as Artificial Intelligence (AI) might be applied in a surgical context.

"We are trying to use digital technologies to improve the performance of surgery and assist in better performance for better delivery of medicine – digital medicine."

According to Professor Ronan Cahill, "This research programme brings together world-class expertise from the Mater Hospital, UCD, RCSI and IBM Research here in Ireland. Beginning with cancer, our work has the potential to transform surgical practice and improve patient outcomes across a range of conditions and on a global scale."

Pól says part of this research is focused on image-assisted surgery, using a combination of smart cameras and fluorescence imaging. The aim is to precisely characterise types of tissue encountered during surgery, and so assist medics to make decisions that are personalised to the needs of the patient.

"Indocyanine green (ICG) is a medical dye used when the patient has been given anaesthetic, to help determine the cardiac output, liver function, and blood flow in the liver. After it's been injected, if you shine a fluorescent light source on the patient, their external and internal appearance is green."

Pól continues, "If you watch the dye very carefully, you'll see the changes in colour happening, but it may not be behaving in the same way, for example changing colour as quickly, in some parts of the tissue as in others. This difference in dye

behaviour is traditionally used as a targeting aid, to help identify where the tumorous tissue might be."

The downside of this fluorescent technique is that it's possible to miss subtle changes, particularly during a busy surgery.

"However, a computer can spot subtle changes far faster than the human eye can," says Pol. "So, the project looks at how the relevant information, such as where the cancer is for example, can be extracted from the changes observed by the computer and relayed back to the surgeon using AI and maths."

Pól says this would this help to tackle challenges in the planning phase of the surgery – for example helping the surgeon identify what they are seeing – and in the post-operative phase. "By using these techniques, we hope to allow the surgeons to have a minimally invasive surgery, to reduce complications post-surgery and improve the prospects for longer-term recovery."

Improving home-based integrated care

In the personalised care field, to assist with providing support for older adults (65 and over) living at home, IBM Research is collaborating with the Trinity Centre for Practice and Healthcare Innovation (TCPHI) at Trinity College Dublin on ProACT.

Co-ordinated by Dr John Dinsmore of Trinity College, the programme looks at how new technologies can help to support people living with more than one chronic health condition, and to improve the care they receive. With trial sites in Ireland, Belgium and Italy, the project seeks to improve and advance home-based integrated care for older adults with multimorbidity, which is the presence of multiple diseases or conditions.

"As we age, more conditions develop, from high blood pressure to heart problems," says Pol. "Currently, these are treated as individual conditions, and so ProACT is trying to understand them as a group of comorbidities that can be managed together. We're investigating ways wearables, home sensors and tablet applications can be used to help persons with chronic multimorbidity self-manage, as well as assist their support actors, including their family, caregivers and health professionals."

ProACT aims to provide older people with the independence to manage their conditions at home. "This, too, would help take some stress off the primary care system, so that the hospitals are not overburdened with patients."

In addition to Trinity and IBM, the project includes a number of researchers and academic institutions such as Dundalk Institute of Technology – which has the NetwellCASALA Research Centre for Aging – and multinational tech company Philips.

Pól says that partnership between tech, medtech companies and clinicians plays an important part in developing digital health technologies.

> "How can people see digital health as something important that is giving them important information that can help them better manage their lives? How do we empower people?"

"Care providers need to get a lot more done for less cost, in less time and with less resources. By having access to some of these innovative tools, healthcare providers are able to get better guidance, instruction and information, so they can perform more effectively and make better decisions when it comes to patient care."

Empowerment

Pól adds that it's wonderful to see Sláintecare, the ten-year programme aiming to transform Irish health service, and the HSE show an interest in the projects. "We've also had numerous discussions with the EU for further research funding, to expand the projects internationally.

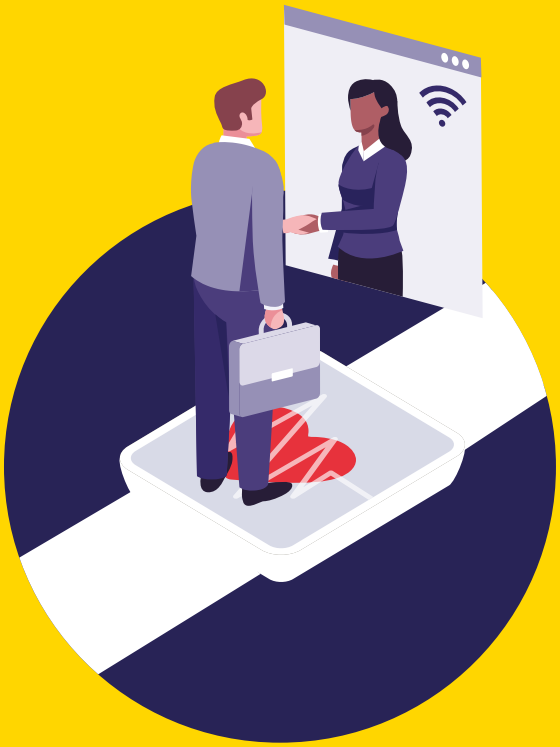
"With Covid taking over, it will be interesting to see whether there's a renewed or a deeper understanding of how close to capacity we run the healthcare system. I do think that there is increased reflection in Ireland's healthcare system now on how we can ensure that the system is more robust and resilient to potential future health shocks."

However, Pól says there is work needed to understand how to change people's behaviours. "How can people see digital health as something important that is giving them important information that can help them better manage their lives? How do we empower people?

"Essentially, I see digital health providing us with a lot more detailed input from top to bottom – from the delivery of care, all the way up to how systems are budgeted.

He adds, "With digital health, we should be able to build much more adaptive, real-time and relevant perspectives of what's going on in people's lives, and plan and deliver healthcare accordingly."

Achieving the full potential of the cluster



Digital health is underscored by collaboration and actionable information. Businesses in Ireland are creating a new age of digital health solutions with tech companies working with medtech companies to help devices ensure data security, and pharma companies remain compliant as they gather data across platforms. Moreover, new technologies are empowering patients to manage their own care and encouraging providers to reimburse digital health solution that lead to efficient care. With cross-sectoral partnerships for success in Ireland, many companies are using Ireland as testbed to go global.

Ireland as testbed for innovation and collaboration

Kieran Daly, Chief Technology Officer and Co-founder of HealthBeacon, talks about their injection care management system (ICMS), partnerships and Ireland's support for digital health companies.

"We saw the struggles that patients were having in the home with staying on track with their medications," says Kieran Daly from HealthBeacon, a leading medication adherence technology company. "On average around 50% of patients are not adhering to their medication after a year according to the World Health Organization, which is a big problem for patients, doctors and even drug companies.

"One of the most common delivery methods for chronic medications is self-injection. In brainstorming how to support patients, healthcare professionals and pharma clients, we realised that every patient needs a sharps bin in the home. So, what if we made these bins smart and allowed people to check whether they had taken their medications or not. That's why we created HealthBeacon, the world's first smart sharps bin."

The HealthBeacon smart sharps bin is digitally connected via an integrated SIM card and is programmed with a patient's medication schedule. It uses customised reminders to help patients start and stay on track with medication.

"It captures the moment of disposal, timestamps it, gives the adherence score and date of next injection on the screen on the top of the bin," says Kieran. "If a patient disposes of their medication 4 August at 1pm, for example, this will be photographed and updates the patient record which can then be viewed by those looking after that patient's care.

"This helps people to make decisions that will improve their own contributions to the management of their condition. We are enormously proud of this innovation, as it is having a measurable impact on medication adherence of patients. As many as 96% of patients accept HealthBeacon as part of their treatment."

Partnership

Patients can stop taking their medication for many different reasons, and during the Covid-19 lockdown, one of those reasons was the restriction of movement and some losing easy access to a pharmacy. In fact, Kieran says that during peak lockdown, there was a 20% drop in patients taking their injectable medication on time. That is why HealthBeacon launched a new Covid-19 support offering for patients which was reimbursed by private health insurer Laya Healthcare. The insurer reimburses the HealthBeacon benefit to help their members stay on track with their treatment.

The Covid-19 support is available to Laya's members which includes virtual care support, coordination of medication delivery, medical waste collection, and home monitoring. Kieran says that Covid-19 has shown the importance of patients being treated remotely and away from the hospital unless, of course, a visit is deemed necessary. And payors, such as insurer and hospital systems, are now opening up to this in a systemic shift, from fee-for-service towards fee-for-value and fee-for-outcome.

"Insurers like Laya are thinking of more intelligent use of these medications and the feedback loops that go with them. Insurers are such a big stakeholder in the whole ecosystem. They can influence more pharma companies and device companies to think about how to be more effective in the treatment of patients. Once the payors start to establish new rules, then the whole market sits up and takes notice." HealthBeacon has successfully established other partnerships with pharmaceutical companies, AbbVie and Teva.

"We launched with Teva around four years ago on a medication called Copaxone, which is a drug used for multiple sclerosis taken three times a week," says Kieran. "It's one of those trickier medication schedules and we can see the impact the injection care management system has had. Any patients in Ireland who are written a script for that medication, are automatically offered a HealthBeacon unit as part of the process."

Clodagh Kevans, Teva's Speciality Medicines Director, shared their perspective on the collaboration, "HealthBeacon and Teva have an excellent partnership in Ireland. We know that the patients really value the service and the impact it has had on patients has been extremely positive."

Following the success of the Teva Copaxone program, Teva partnered with HealthBeacon to offer the ICMS to patients on their new medication Ajovy for adult patients with severe migraines. Kieran says this medication is being considered for European rollouts too.

HealthBeacon also partners with AbbVie on the medication HUMIRA, which helps treat rheumatoid arthritis, Crohn's disease, psoriasis, and other immune-mediated inflammatory conditions. HealthBeacon now supports this medication across several European markets.

"This international reach is important to us, as we wanted to design and build something scalable which could benefit patients across cultures and regions. So, as of today, we're in 14 different countries around the world, from the United States to South Africa. We have a good global spread."

Home support

HealthBeacon is a digital therapeutics company, and Kieran says that Ireland as a whole is a good-sized market for these digital health companies.

"Ireland has been a fantastic place to launch and build our success," says Kieran. "We have developed the business by having a trial and pilot in Ireland, and using that as a blueprint for exporting and bringing it into other markets. I have noticed many other companies doing this too. We have access to pharma companies and medical device companies. Being a small country makes it easy to have this type of grassroots support, which is something I don't see much in other markets."

Kieran says the way Ibec's Digital Health Working Group has approached things has also been a fantastic help. "They acknowledge that there's a blend of people needed in this ecosystem. You need your big pharma companies, but you also need the new generation of up-and-coming indigenous businesses. For us, they have supported us by getting us in the room with these powerful companies as equals, so we can develop direct relationships. The environment they have created is one of support and equality."

Making care better

With HealthBeacon's success in Ireland and global markets, Kieran says their aim has never wavered. Our vision is to continue to connect people to better health through sustainable, digitally enabled solutions.

They are focused on helping with medication adherence in order to aid patients to have better treatments. It helps them have more open and frank conversations with their doctors, but it also has economic benefits too.

"Medication adherence also means that you could see a reduction in the acute hospital population levels. Anything that can stop a patient going to the hospital will always save costs and improve the ongoing health and wellbeing of thousands of lives. And that's the most important thing."

Supporting healthcare software and services

Oisín Curran, Chief Executive at Odyssey Validation Compliance, talks about supporting life sciences companies in their implementation of computerised systems.

"We were seeing innovation in both services and technology happening in the life sciences sector," says Oisín Curran, who has over 20 years' experience in the life sciences industry and in designing and implementing GxP computerised systems.

"So, we decided to develop fully integrated GxP Cloud and Computerised System Lifecycle Management Services, to support regulated companies and connected health startups with their business processes."

GxP refers to good practice regulations and standards, created to ensure pharmaceutical products are safe and meet their intended use. GxP software systems help companies comply with these requirements.

"We represent our clients in the implementation of computerised systems and ensure that they're audited, ready and fit for purpose."

Hosting

Oisín explains the company, which is based in Co Kildare, ventured into the digital health space back in 2015, when they were requested by a pharma customer to do an audit of cloud providers.

“We had to help determine which provider could provide a compliant hosting platform for a regulated application that this company was looking to put in the cloud.

“We conducted the audit for the company, and some well-known commodity cloud providers were not fit-for-purpose, in terms of their regulatory framework. And that's where the second part of our business came from.”

Odyssey Validation Compliance developed a fully compliant global hosting platform called compliantcloud.com. This software as a service (SaaS) solution allows users to operate a software application and data entirely from the cloud, at a fraction of the cost of managing it in-house.

“Not only are we able to help people implement applications in line with regulations, but we're able to host, manage and support them. This allows digital health companies to focus on what they're good at, which is the digital health product or solution they provide. And we focus on the end-to-end compliant application delivery and maintenance at the backend.”

Oisín explains, “Take, for example, a medical device company that is looking at enabling wearables for use in hospitals. By their nature, they’re connected at the backend – the portion you don’t see, which sends and receives information – through a compliant hosting platform for data management and privacy. We’re the backend, or framework, for any digital solution.”

Compliance

Having once been a start-up company themselves, Odyssey Validation Compliance feels it is important to develop tailored solutions and use a collaborative approach, especially with clients that are startups.

“As we have grown ourselves as a company over the years, we have a start-up mindset. We're aware of the barriers to entry across compliance, engineering, and product marketing. We know there are many challenges for startups, because we were once there.

“It’s really important that we understand the part we play in helping great products get to market, and particularly for Irish companies, being Irish ourselves. Generally, start-up companies require a lot of handholding and that can be expensive. So, we try to collaborate with a couple of key players in the market to make sure that what we do is scalable and reproducible in a more cost-effective way.”

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> We see our company as an example. As a compliance service business, Odyssey strives to support the Lifesciences and Connected Health industry, regardless of the size of the company.

Oisín says this is the reason the company follows an OpEx model (an ongoing cost for running a product or system). “The idea is that we will onboard customers and make a commitment in terms of arranging a stake in the shares to recover the cost over time. This allows companies to onboard at a lower entry point, but allows them to see how they can scale up their product. And they’ll have an entire compliance team without the overhead.”

Oisín always advises startups to consider compliance from the beginning, “because compliance is essentially a barrier to entry and commercialisation. You cannot commercialise digital health products without covering your compliance aspects. And you do not want to discover that too late in your life cycles.”

Bespoke products for Fortune 500s

Odyssey Validation Compliance also works closely with a variety of multinational, Fortune-500 style companies. Oisín says, “For example, there's a global Fortune 500 company that we've helped to develop a bespoke product focused on going paperless. It’s interesting, because this is a very large US Life Sciences company, with many heavyweight incumbents and consultancy firms. Yet, they came to us. People are seeing value in the real niche in what we do. “That's something I'm really proud of us for, as a company. We have that bandwidth to be able to deal with small specific use cases for startups, but also on a larger scale.”

With experience working both internationally and in Ireland, Oisín says there are many benefits to doing digital health activities in Ireland.

“The Irish engineering skillset is relatively well-known right now. We have seen a lot of cases where manufacturing has moved to more cost-effective offshore manufacturing locations, but has subsequently moved back here. A lot of the time, it's because of the engineering and compliance skills to be found in Ireland.

“Irish companies have a real focus on quality. I find people are focused on doing the right job, and doing a good job. Ireland has a fantastic breeding ground in terms of digital health companies and incubation hubs that are developed in some of the universities. We've got fantastic technology support hubs, to be able to solve real industry solutions.

“We see our company as an example. As a compliance service business, Odyssey strives to support the Lifesciences and Connected Health industry, regardless of the size of the company.”

Oisín adds, “And I do think there are a lot of really strong technology providers that are not just looking at solving problems for the Irish market. They’re thinking on a global level.

“Across the board, we've always had that ability to think bigger. That ambition around how we can serve as a global customer base is something I see time and time again with Irish companies, which is great.”

Supporting a thriving ecosystem

Ireland's government agencies have an international reputation for supporting startups go global, attract FDI multinationals here as location of choice, and deliver industry-led training to address changing needs to help businesses here achieve their ambition. Innovation is a cornerstone of these policies with supports to ensure that the digital health industry can identify unmet clinical needs, develop disruptive solutions and get them to market. As a small country we're making a big impact by working together.

Helping indigenous companies go global

David Byrne, Manager of the Digital Technologies Department, Enterprise Ireland speaks about overcoming challenges in the healthcare industry through digital transformation and the importance of supports for Irish companies to bring their innovations forward.

"The digital health sector is a global phenomenon and provides a huge opportunity," says David Byrne. "What we're seeing is a convergence of technology, medtech, pharma and healthcare, to deliver value through data harnessing and analysis for healthcare providers and clinicians, all the way through to manufacturers."

And David says Ireland is a centre of excellence in both pharma and Information and Communications Technology (ICT). "We are very well-placed because of our pre-existing knowledge, expertise and performance to-date in both of those sectors."

Overcoming challenges

While there are challenges to overcome in the healthcare industry, the recent pandemic has brought about opportunity. "There are long-term challenges such as an ever-increasing ageing population, and the complexity and expense of medical treatments that are rising all the time. People are living longer with more complex healthcare needs and the funding models are struggling to keep pace.

"There's a real need to meet the supply-and-demand challenge and digital transformation is driving significant transformation across all of that."

David continues, "The challenges are obviously compounded by the urgency in terms of what's going on with the global pandemic, so that's taking immediate attention. However, there has been a lot of success in that Irish companies have been innovating leading technologies to address some of the challenges."

Covid-19 has demonstrated the ability of the Irish industry to innovate. "For companies to be able to respond with a fully approved medical device – which would normally have taken years to approve – in a matter of weeks or months is impressive.

"For example, NearForm, an Irish company in Waterford, developed an app for Covid-19 tracing. It's being used across Ireland, in Scotland, in Gibraltar and it's being looked at in other countries."

David adds that Covid-19 has also demonstrated the opportunity for remote engagement, "Be that in the provision of healthcare in the home, including remote consultation from doctors and so on. People are developing innovative solutions, so that patients can get the healthcare they need in a safer, more efficient way, but without encountering the risks." "You can also see these kinds of tools that the Irish have companies innovated persisting into the future."

Partnership and support

When it comes to being a global leader in the development and deployment of digital health solutions and products, partnership right across the value chain is the only way forward.

"It's a complex environment. There's a range of expertise and knowledge involved, everything from the innovation to the technology. Then, you have to think about how the innovation is supported and how it's engaged with the potential end customer.

"All of these are very complex steps and companies need to form partnerships in order to bring in the expertise they lack. This will ensure the route to market is maximised and that companies have the greatest possible impact and the greatest potential for growth."

Supporting the digital health ecosystem is vital, "The Government is committed to supporting innovation, as are Ibec and Enterprise Ireland. Enterprise Ireland has the supports to help our companies take their innovative solutions from the concept stage, right through to the marketplace.

"There's a very supportive environment in Ireland, and ways to ensure that innovative ideas get every opportunity to develop and succeed."

"The challenges are obviously compounded by the urgency in terms of what's going on with the global pandemic, so that's taking immediate attention. However, there has been a lot of success in that Irish companies have been innovating leading technologies to address some of the challenges."

Bringing investment to Ireland

Rachel Shelly, Department Head for Medical Technologies and Healthcare Services for IDA Ireland, talks about the digital health and why Ireland is the perfect place to support growth in this space.

IDA Ireland is the inward investment promotion agency which works with multinational companies to establish operations around Ireland. It also helps these companies grow and transform their operations once established.

Rachel says the IDA work with around 1,500 companies, across the spectrum of business. These companies range from life sciences such as medtech and biopharma companies, to engineering, financial services, technology and digital services.

Rachel, who heads up the department for medical technologies and healthcare services, says that foreign investment in the medtech industry in Ireland and the depth and breadth of the technology cluster means greater opportunities for convergence with life sciences and an ideal environment for innovations in strategic areas such as digital health.

Investment in Ireland

Rachel says that with Ireland's proven track record in medtech and technology, access to a talented workforce and highly connected industry and academic ecosystem, it is a key destination for global companies.

"Ireland is able to entice major companies because there is an ecosystem here like no other," says Rachel. "We have 9 of the top 10 medtech companies in the world located here. Nine of the top 10 technology companies and 17 of the top 20 software companies are all thriving here too. We have an incredibly diverse and talented workforce and universities are generating high calibre graduates every year.

"Ireland has this huge cluster of capability, skills, from device production, to software engineering within a supportive well regarded regulatory environment which is critical in this sector. There is a vibrant ecosystem for international and indigenous companies in the life sciences to evolve and develop their operations."

As Ireland is a small country, this can be seen as an advantage rather than a drawback. Companies and suppliers can be physically located close to each other and to internationally well-regarded universities, research centres and 3rd level institutions.

"I think we are very unique as a location in this respect. In addition, there are attractive supports provided in Ireland such as the 25% research and development (R&D) tax credit, and grants which helps to incentivise innovation in business. And of course, support from the enterprise agencies such as IDA Ireland and Enterprise Ireland."

Rachel says that IDA Ireland provides assistance to companies, partnering with them from the start and helping them to set up quickly and successfully. IDA then provides ongoing assistance to companies to help them evolve and grow their operations. "Many companies have completely transformed their activities over time from pure manufacturing operations to include product/process innovation centres of excellence, and increasingly adding Global Business Services activities".

"There are many companies such as Medtronic, Stryker and Cook Medical with customer innovation centres here focused on next generation products and solutions. Other companies like BD, DePuy Synthes and Boston Scientific have important research and development activities in Ireland supporting their global businesses. The connected health space is growing in Ireland, as more companies look to integrate new technologies with their devices, generate better data and enhance patient experiences to deliver a new wave of Medtech solutions.

Rachel adds, "All of these elements really speak to the fact that it's a great time for innovation, convergence and digital health in Ireland, and there is a great appetite within the Irish system to support companies on this journey. As long as companies continue to be ambitious and forward looking, there's no doubt Ireland will continue to be a global leader in the industry."

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Creating knowledge from data

Brian Caulfield, Professor of Physiotherapy and Director of the Science Foundation Ireland (SFI) Insight Centre for Data Analytics at University College Dublin, on how connected health can help those at risk better manage their conditions.

"My research is focused on how we can understand and improve human performance and behaviour in health and sport, using data-driven methods, wearables and mobile technologies," says Brian Caulfield, who has an extensive background in physiotherapy. "This could be related to an older person who is at risk of falling as they move throughout their home, or understanding how an athlete is recovering from an injury like a concussion or a sprain."

The SFI Insight Centre for Data Analytics at UCD, of which Brian is Director, is one of Europe's largest data analytics research organisations with over 450 researchers. The Centre also has more than 100 partner companies, to help develop new data-analytic technologies in many application domains, including health and sport.

For example, the Centre has worked with Irish medical device company Kinesis Health Technologies on their development and validation of digital biomarkers based on sensor data collected from people performing simple clinical tests, such as walking and rising from a chair. “We use the data to understand whether or not these people are at risk of falling. By identifying people who are at an increased risk of falling, you can implement preventative measures to stop them from falling in the first place.”

The SFI Insight Centre for Data Analytics has seen the successful spin out of Output Sports by two of its PhD graduates. Output Sports have brought laboratory grade sports performance to the field setting using a combination of machine learning, mobile and wearable sensor technologies. Their platform tests various aspects of athletic performance, and helps coaches to track and optimise their athletes’ performance.

“We've also been working with the Irish Rugby Football Union (IRFU) to research and digitally measure risk of and recovery from concussion. We have been able to use data from wearable sensors to identify players who are at increased risk of sustaining concussion, and have been able to track recovery using the same methods.”

“We use the data to understand whether or not these people are at risk of falling. By identifying people who are at an increased risk of falling, you can implement preventative measures to stop them from falling in the first place.”

Actionable information

Brian says connected health is beneficial in that it is moving healthcare from the hospital and clinic into the day-to-day lives of patients.

“Digital health is about having a new paradigm for managing people's health throughout their lifespan. This is by means of connecting the stakeholders in the system and making sure that they all have the right information in the right place, at the right time, to enable them to make the best decisions.

“Today, we have the capability of providing somebody with a powerful computer in their pocket or a wearable sensor on their body, and they can move throughout their daily lives or play sport as normal. We are then able to digitise their behaviour and performance, and try to understand how the information can be used to alert them to the risk of something bad happening,” says Brian. “Or, remind them to take their medication.”

However, Brian says there are challenges when it comes to turning the data collected into actionable information relevant to different stakeholders. “It’s easy for us to capture digital information, be that through using devices like Fitbit, for example.”

But capturing data is just the beginning of the process. “We do a significant amount of research to turn that data into actionable information that is relevant for industry and clinicians/coaches. It's not just a simple process of dropping a solution into the ecosystem and healthcare professionals start using it tomorrow. There's an organisational and personal behavioural change element that's required in the health system.”

Sense of collaboration

Brian says one great thing about Ireland is that it’s a small country with big ambition, “Being a small country means different parts of the ecosystem are accessible to each other. We have a strong sense of collaboration across sectors, different disciplines and even across our academic institutions. I think that’s a huge positive.”

He adds, “Ireland has been behind the rest of the world in terms of digitising our public health system. But there's a lot you can learn sometimes by not being first; we can learn from the mistakes of others. “And I think we can build a really connected system here if we have a combination of political will, open collaboration and open innovation.”

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Support lifelong learning for a worldclass knowledge economy

While Ireland's productive workforce has helped us to attract international investment and inspire entrepreneurs to found companies here, more must be done to support upskilling as today's skills may not be enough to invent tomorrow's disruptive technology. As a competitive knowledge economy we need to build on our success by doing more to embrace lifelong learning by tapping into supports to help businesses and people achieve their potential by embracing new technologies and careers opportunities in the face of change.

Supporting Irish competitiveness

Paul Healy, Chief Executive and Tracey Donnery, Executive Director at Skillnet Ireland talk about Ireland's innovative digital health sector and how Skillnet Ireland helps with upskilling Ireland's workforce.

"The extent to which any country is competitive is based on the workforce itself," says Paul Healy, Chief Executive of Skillnet Ireland, a government enterprise support agency. "We have an incredibly talented and capable workforce. However, we have to constantly work on upskilling to keep up-to-date with the biggest trends, whether that's digitalisation or the green economy, which are both critical issues today."

Skillnet Ireland advances the competitiveness, productivity, and innovation of Irish businesses through enterprise-led workforce development. Working with over 50 industry representative groups, they support over 18,000 businesses and 70,000 workers annually.

Skillnet Ireland funds enterprise-led business networks that provide subsidised upskilling to all areas of Irish business, from animation to biopharma, from construction to agri-food, making many business sectors more competitive and more productive.

"We have a strong presence across all key industries. We have partners in retail, in hospitality, in tech, and so many more. The impact of Covid-19 shows just how vital it is to be ready for any change. And that's what our work at Skillnet Ireland is focused on. We want to ensure that Irish businesses and the workforce has the skills it needs to adapt to the next wave of challenges and opportunities."

Connected Health

Connected health refers to a model for healthcare which uses technology to provide healthcare services remotely. Skillnet Ireland supports the vision and strategic objectives of the Connected Health Skillnet, promoted by IBEC.

"We are constantly scanning for the next major trend in business or the next major innovation across all sectors," says Paul. "We realised that the emerging field of connected health was gaining momentum and important to support for Ireland to become a global leader in connected health development. We can positively leverage the strengths of enterprise to deliver innovation into this new growth areas. We look at the trends that are shaping industry, and what the talent responses are needed to stay ahead of the curve."

The Connected Health Skillnet network supports companies involved in connected activity by providing them with industry insights, upskilling and networking opportunities. These companies can either be adding connectivity to current products and services, or developing new connected health/ smart products and services.

"Skillnet Ireland facilitates strategic partnerships with higher education institutes and industry bodies to develop new programmes that address future business needs. Our model enables enterprise groups and trade associations to entirely control this process so that innovative solutions are built with industry backing from the ground up. The Connected Health Skillnet can help produce the type of talent to facilitate Ireland making the next major shift in connected health in this country." outlines Tracey Donnery, Executive Director at Skillnet Ireland.

Ireland is already globally recognised for its technology, medtech and pharma industries. Tracey says Skillnet Ireland's aim is to enhance Ireland as a location of choice for connected health companies who want to develop solutions. "The potential innovation in this sector is really exciting, as there are so many beneficial health outcomes as a result of connected health."

Leading the way

Paul says Ireland is one of the biggest hubs for medtech on the planet. This means that Ireland can easily become a leader in the development of digital health solutions.

"In order to have a big presence in this global industry, Ireland must maximise the talent we already have as this creates opportunities for an even stronger medtech presence in this country. We need to further collaborate with universities and ensure that we continue to invest in people. We should also continue to have more investment in R&D.

"There is so much good work already underway to ensure Ireland's position. Not just from industry, but also from agencies such as Science Foundation Ireland, Skillnet Ireland, IDA Ireland, and Enterprise Ireland which are all supporting the whole ecosystem around medtech. This is what will develop and keep this industry prospering in Ireland for the long-term."

"We have a strong presence across all key industries. We have partners in retail, in hospitality, in tech, and so many more. The impact of Covid-19 shows just how vital it is to be ready for any change. And that's what our work at Skillnet Ireland is focused on. We want to ensure that Irish businesses and the workforce has the skills it needs to adapt to the next wave of challenges and opportunities."

Industry-led training for digital health leaders

Jennifer McCormack, Network Manager of the Connected Health Skillnet, talks about supporting innovation and encouraging collaboration between the medtech, pharma and technology sectors.

"Delivering cross-sectoral, enterprise-led training is essential for the digital health industry in Ireland to achieve its potential as we need a strong talent pipeline to stay ahead of the latest trends." says Jennifer McCormack. She adds, "Not only do companies need access to niche training which the Connected Health Skillnet delivers, the networking opportunities we provide also help them identify new partners to drive innovation and business development."

The Connected Health Skillnet is a multi-sector learning network, which was established to address the current and future skills needs in the field of digital health. The network is promoted by Ibec and operates in collaboration with the Irish Medtech Association, BioPharmaChem Ireland and Technology Ireland.

Capitalising on opportunities

"The Connected Health Skillnet is a very flexible, industry-driven model," says Jennifer. "The convergence of medical technologies, pharmaceuticals and the technology sector is transforming healthcare by offering better patient outcomes, as well as creating new ways for patients to access and manage their health."

When the Irish Medtech Association 2020 strategy, 'The Global Medtech Hub', put a focus on facilitating engagement between sectors to improve innovation and collaboration. "We saw an opportunity to support this ambition by addressing the skills needs where there was digital health convergence. With new technologies and business models evolving in digital health it was clear there was an unmet demand for new training programmes."

"We get valuable insight and strategic direction from our steering group which is made up of senior leaders from the medtech, tech, biopharma and digital health industries."

Niche skills for major growth sector

The Connected Health Skillnet was launched in 2017 to sustain the talent pipeline and help the sector remain competitive. The Skillnet has already engaged with 175 companies from across the medtech, tech, pharma and digital health sectors to upskill over 700 trainees in critical areas to equip the ecosystem.

Jennifer notes that one of its most successful programmes is the Medical Technology Leadership Programme, which was developed to enhance the capabilities of the sector's current and future leaders. "This course provides knowledge of all aspects of the medical device and diagnostics business required for strategic leadership. We've incorporated customised lessons for digital health leaders to help them better understand and make the most of opportunities."

The Level 8 Medical Software Quality Assurance programme has also played a huge role in helping to upskill both medical device quality professionals and software engineering professionals to take up software quality roles. This programme focuses on critical areas such as, software testing, medical device software standards, and regulatory requirements for the industry.

Jennifer adds that another important area for training is data science, "Understanding data and identifying actionable insights is an essential element of developing digital health solutions. We need to ensure that we have a workforce that is equipped to interpret healthcare data to understand trends and to leverage that data to develop new solutions, new therapies or generate real-world evidence."

Building relationships to thrive

According to Jennifer, upskilling and reskilling with the Connected Health Skillnet can help to make Ireland a location where digital health thrives. The Connected Health Skillnet works with companies of all sizes and their programmes are part-funded by Skilllnet Ireland through the National Training Fund from the Department of Further and Higher Education, Research, Innovation and Science. Jennifer explains that, "This allows us to provide significant grant subsidies to companies on the cost of training. We can also work with companies to fulfil their development needs and identify suitable programmes to address skills shortages on a company level, or the sector as a whole."

Jennifer highlights that one of the most important aspects of the Skillnet is that all of the training is developed with industry input and brings together the unique perspectives of all the key sectors. "We get valuable insight and strategic direction from our steering group which is made up of senior leaders from the medtech, tech, biopharma and digital health industries."

By hosting events such as the Digital Health Masterclasses the Skillnet facilitates interaction and showcases innovation, which is important for developing a shared language and understanding of what digital health means to each sector.

A really unique aspect of, not only the Connected Health Skillnet and Ibec's network of companies, but of the industry here in Ireland as a whole, is the willingness of professionals at all levels to come together to build relationships and share best practice with each other to help the wider community compete in the international arena. That willingness to collaborate is what makes Ireland a location where digital health will be able to thrive."

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