

# MONITORING PROGRESS IN NATIONAL INITIATIVES ON DIGITISING INDUSTRY

## Country report

*Ireland*

*July 2019*



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## Summary

Ireland belongs to the high-performing cluster of EU countries in terms of digitisation. Ireland is ranked 6<sup>th</sup> according to the Digital Economy and Society Index (DESI) in 2018, which is an increase of three places in the ranking compared to 2017. It is due to an improvement in each of the five DESI dimensions – all of them are also above the EU average. Ireland is a leader in the number of STEM graduates and presents excellent results in the indicators measuring the use of online commerce by SMEs, Open Data and Digital Public Services for Businesses. The improvement areas for Ireland are the current shortage in ICT-specialists and over half of the adult population lacking digital skills.

Ireland's economic performance in the last few years has been positive with a yearly GDP growth on average of 12.4% between 2015 and 2017. During the same period, the GDP per capita increased by 10%, with the year 2015 demonstrating an immense economic improvement (+25% real GDP growth compared to the previous year) according to Eurostat.

There is a high level of cooperation between government and industry stakeholders in designing national initiatives. Following up on the Phase 1 of the National Digital Strategy (NDS), the development of Phase 2 is currently underway, aiming to drive the application of digital technologies horizontally across society, the domestic economy and the wider European single market. The development of an Industry 4.0 Strategy for Ireland is in progress and is aimed at supporting the digitalisation of the manufacturing sector and its supply chain in the coming years. Work on the development of a national Strategy on Artificial Intelligence has also commenced. At least EUR 308 million has been made available since 2014 across the national strategies and the initiatives under the different pillars of the Digitising European Industry (DEI) initiative and support mechanisms.

Within Pillar 1 of the DEI, Ireland actively cooperates with the ICT Innovation for Manufacturing SMEs (I4MS) and EU Joint Multi Stakeholders Platform through initiatives focused on R&D and International Standards Development. Ireland has recently launched a number of initiatives with the focus on Pillar 2 & 3 of the DEI (adopting new technologies and increasing the use of innovation), with the main focus on DIHs and Research Centres, for a budget of at least EUR 103.5 million since 2015. Some of the initiatives, such as the Investment Programme of the National Digital Research Centre target start-ups and SMEs that lag behind larger companies in terms of digitisation level and use of modern technologies. The changes within the regulatory framework to be fit for the digital age (Pillar 4 of the DEI) are currently under discussion and the update of the National Cyber Security Strategy is expected. The recently launched initiatives within Pillar 5 aim to increase digital skills of the Irish population – both students and workforce. Certain programmes have been launched to address the problem of the digital skills shortages and the lack of ICT specialists. Since 2015 at least EUR 117.4 million has been allocated for the initiatives within this Pillar. Finally, some supporting mechanisms contribute towards digital development, among them the Trading Online Voucher Scheme (at least EUR 8.4 million allocated since 2014) and the Disruptive Technologies Innovation Fund, which will start funding the selected projects in 2019 and has an overall budget of EUR 500 million.

Table 1 below presents an overview of the main initiatives identified in Ireland that will be further detailed in this report. Table 2 presents a short SWOT analysis of the Irish economy on digitalisation.

**Table 1: Overview of initiatives**

Initiatives	Starting year	Overall strategy / DEI Pillar / support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
Doing more with Digital (2013) 'Phase 1 – Digital Engagement'	2013	Overall strategy	Horizontal strategy	All	All	All	EUR 27 million (between 2013 and 2018); public funding (source: National Government)
Investment Plan of the National Digital Research Centre	2007	Pillar 2 & 3	DIH	Programme is not sector-specific. Digital technology across multiple sectors from Finance, Environment, business software, health, property, agriculture to travel	All	Micro, very early stage companies	EUR 14.5 million between 2015 to date
IDA Ireland and Enterprise Ireland Technology Centres Programme	2010	Pillar 2	Technology Centres	Programme is not sector-specific	All	SMEs and larger businesses	Public funding of EUR 18.3 million in 2018
IDA Ireland and Enterprise Ireland Technology Gateways	2013	Pillar 2	Technology Gateways	Programme is not sector-specific	All	SMEs and larger businesses	Public funding of EUR 5.7 million in 2018
SFI Research Centres	2013 (Confirm and I-Form started in 2017)	Pillar 2 & 3	RD&I Centre	The 17 SFI Research Centres operate in areas of demonstrable potential economic impact for Ireland, as identified in the	With specific regard to digitising industry, two of the Centres have focus on Advanced Manufacturing – I-Form	SMEs and larger businesses	Over EUR 63.2 million allocated for 17 Research Centres in 2018  In addition to the SFI funding, the SFI Research Centres (Confirm and I-Form) must obtain 30% of the total Centre budget

Initiatives	Starting year	Overall strategy / DEI Pillar / support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
				Research Priority Areas 2018 to 2023. Sectors include manufacturing, ICT, health, energy, sustainability and food.	(additive manufacturing) and Confirm (smart manufacturing)		from industrial co-investment for collaborative research projects. The SFI contribution equates to a maximum 70% of the total Centre funding. Funding source: SFI and ERDF.
Pervasive Nation Testbed	2016	Pillar 2	Testbed	All	Mobile services, IoT, Big Data and Data Analytics, AI	All	EUR 1.8 million (Jan-Dec 2016) SFI and co-funded under ERDF
Digital Hub Development Agency Act 2003	2003	Pillar 4	DIH Regulation	All	N/A	N/A	N/A
National Cyber Security Strategy	2015	Pillar 4	Government strategy / Legislation	All	N/A	N/A	N/A
'Digital Skills for Citizens' Grant Scheme	2016	Pillar 5	Training	All	N/A	N/A	EUR 4.2 million to February 2019 (source: National Government)
School Digital Champion Programme	2015	Pillar 5	Training	All	N/A	N/A	N/A (source: National Government)
Springboard+	2011	Pillar 5	Training	ICT, Engineering, Manufacturing, Medical Devices, Construction; Hospitality, Business, Administration, Entrepreneurship and Animation.	N/A	N/A	EUR 112.4 million available for between 2015 and 2018 (source: National Training Fund)

Initiatives	Starting year	Overall strategy / DEI Pillar / support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
'EXPLORE Programme	2018 (pilot)	Pillar 5	Training	All sectors that have manufacturing as part of their business.	N/A	N/A	EUR 0.75 million (source: National Training Fund)
Technology focused Skillnet networks	2005	Pillar 5	Training	All	All	SMEs and larger businesses	N/A
Disruptive Technologies Innovation Fund	2018	Support mechanism	Innovation Fund	All	All	All	Start of funding in 2019 EUR 500 million to 2027. EUR 20 million was allocated to this fund in 2019.
Trading Online Voucher Scheme	2014	Support mechanism	Innovation Vouchers	Programme is not sector-specific	N/A	Micro enterprises (no more than 10 employees)	EUR 8.4 million between 2014-2018
Enterprise Ireland RD&I Support Mechanisms	Ongoing in various forms since 2000	Support mechanism	RD&I Funding, Innovation Vouchers, Partnerships	Programme is not sector-specific	All	SMEs	EUR 78.7 million allocated to various programmes by DBEI in 2018

\* DEI pillar description in the following link: <https://ec.europa.eu/digital-single-market/en/pillars-digitising-european-industry-initiative>

**Table 2: SWOT of Ireland on digitalisation**

<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>• Leading performance in the number of STEM graduates.</li> <li>• Excellent results in terms of use of online commerce by SMEs, Open Data and Digital Public Services for Businesses.</li> <li>• Governmental and industry involvement and high level of cooperation in designing and coordinating initiatives.</li> </ul>	<p><b>Weaknesses:</b></p> <ul style="list-style-type: none"> <li>• Shortages in ICT specialists (digital skills gap).</li> <li>• Over half of the adult population lacking at least basic digital skills.</li> <li>• The regulatory framework in Ireland still needs to be adapted to the digital age.</li> </ul>
<p><b>Opportunities:</b></p> <ul style="list-style-type: none"> <li>• Recently, the Irish government has launched different initiatives to support the digitalisation of SMEs and to strengthen the digital skills of the population.</li> <li>• Digitalisation could help SMEs in all areas to become more competitive and increase their productivity.</li> <li>• The forthcoming new National Digital Strategy will help Ireland maximise the economic and societal benefits from digitalisation and its transformative effects. The new National Digital Strategy and Industry 4.0 Strategy are expected to drive the Irish manufacturing industry in the following years.</li> <li>• Future Jobs Ireland [HQ] and Enterprise 2025 Renewed are expected to increase the adoption of disruptive technologies among enterprises.</li> </ul>	<p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>• Various levels of digitalisation and productivity gaps between SMEs and larger enterprises that need to be addressed in order to streamline the economic progress on the country-level.</li> <li>• Firms' limited awareness and understanding of the new initiatives and digital solutions available.</li> </ul>

## 1 General context

The objective of this report is to analyse the status of national initiatives on digitising industry in Ireland. The analysis has been conducted against the background of the Digitising European Industry (DEI), which was the first industry-focused initiative of the Digital Single Market launched by the European Commission in 2016. DEI actions are structured around five main pillars:

1. European platform of national initiatives on digitising industry
2. Digital innovations for all: Digital Innovation Hubs
3. Strengthening leadership through partnerships and industrial platforms
4. A regulatory framework fit for the digital age
5. Preparing Europeans for the digital future [FD]

Similar country reports will be produced for each of the 28 EU Member States. These national reports allow to:

- Monitor the development of national initiatives on digitising industry;
- Compare different national approaches; and
- Identify best practices of national initiatives.

Monitoring and reporting back on the development of the existing national initiatives is an important element of the DEI initiative, and this report should be seen as one part of it.

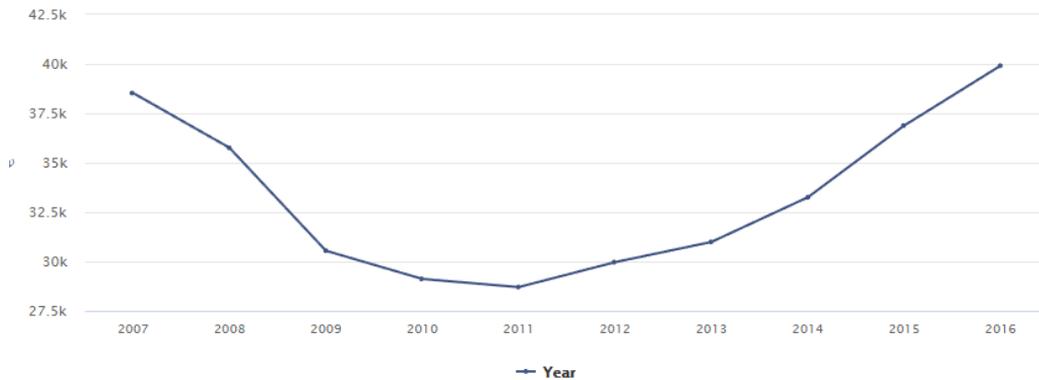
For more details about the DEI and our methodological approach for the country report, please consult the document attached.

### 1.1 Economic context and status on digitisation

#### ***General economic context***

Ireland's economic performance in the last few years has been positive with a yearly Gross Domestic Product (GDP) growth on average of 12.4% between 2015 and 2017. During the same period, the GDP per capita increased by 10%, with the year 2015 demonstrating an immense economic improvement (+25% real GDP growth compared to the previous year) according to Eurostat. GDP is expected to further increase by 4.4 % in 2018 and 3.1 % in 2019. Although the Irish economy continues to grow robustly, it is heavily influenced by the activities of multinational enterprises in Ireland, in particular contract manufacturing and aircraft leasing. Domestic demand in Ireland stays strong with private consumption and construction investment contributing significantly.<sup>1</sup> The modified Gross National Income (GNI) per capita in Ireland has been steadily increasing since 2011 and has reached the pre-crisis level according to the Central Statistics Office (CSO).<sup>2</sup>

**Figure 1: Modified Gross National Income per capita**



Source: CSO Ireland

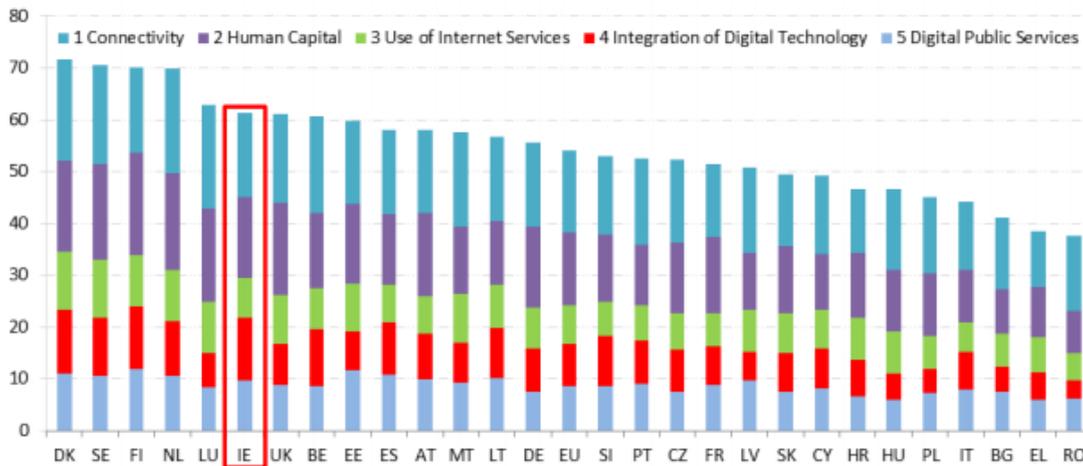
The Irish economy is based on a strong and innovative industrial sector. In 2017, the industry represented a share of the gross value added (GVA) of about 36%, which is above the EU-average of 19.6% as per Eurostat data.

The labour market in Ireland continues to follow a positive trend. In the third quarter of 2017, employment increased across almost all economic sectors by an average of 2.9 % year over year (within the age group 20-64). There have been certain skills shortages reported in some sectors, in particular within information and communications technology (ICT), due to a relatively low level of the population possessing basic digital skills.<sup>3</sup>

### ***Status of digitisation***

Ireland has been ranked 6<sup>th</sup> according to the Digital Economy and Society Index (DESI) in 2018, which is an increase of three places in the ranking compared to 2017. Ireland therefore belongs to the leading group of countries in terms of digitisation and has achieved overall a higher score due to an improvement in each of the five DESI dimensions. All of the dimensions are above the EU average, in particular dimension 4 (Integration of digital technology) and dimension 5 (Digital Public Services).<sup>4</sup> The figure below presents Ireland's position in the DESI ranking.

**Figure 2: Digital Economy and Society Index<sup>5</sup>**



Source: DESI 2018 Country report - Ireland

Ireland demonstrates an outstanding performance in some specific indicators, such as STEM Graduates (1<sup>st</sup> both in 2017 and 2018), three indicators measuring the use of online commerce by SMEs (1<sup>st</sup> both in 2017 and 2018), Open Data (1<sup>st</sup> in 2018) and Digital Public Services for Businesses (2<sup>nd</sup> in 2018). However, Ireland lags behind in areas such as ‘at least basic digital skills’ with over half of the adult population lacking them (23<sup>rd</sup>) and experiences a shortage of ICT specialists. Addressing this supply gap is the target of the recently published Technology Skills 2022, Ireland’s third ICT Skills Action Plan, being a joint effort of the government and key stakeholders.<sup>6</sup>

Access to broadband has been also identified as problematic in the country. Although there is an improvement compared to the previous years in the high-speed broadband coverage, the ultrafast broadband coverage in Ireland is below the EU average according to DESI 2018. This issue has been also mentioned by the industry representatives as a challenge that Ireland will need to overcome in the following years. However, progress is being made in relation to Next Generation Access (NGA) broadband coverage in Ireland (i.e., download speeds >30Mbps), which is above the EU average, which is expected to have a positive economic impact on areas such as entrepreneurship, education, farming and tourism.<sup>7</sup>

According to the World Economic Forum’s Readiness for the Future of Production Report 2018, Ireland’s main drivers of production are its institutional framework and human capital, as presented in the figure below.

**Figure 3: Ireland's readiness for future production**

Readiness Overall Assessment			
Drivers of Production			6.8
Driver	Weighting	Rank	Score /10
 Technology & Innovation	20%	18th	6.6
 Human Capital	20%	14th	7.0
 Global Trade & Investment	20%	16th	6.8
 Institutional Framework	20%	16th	7.9
 Sustainable Resources	5%	36th	6.7
 Demand Environment	15%	30th	5.7
Structure of Production			7.3
Structure	Weighting	Rank	Score /10
 Complexity	60%	13th	8.2
 Scale	40%	14th	6.1

Source: World Economic Forum, Readiness for the Future of Production Report 2018<sup>8</sup>

The table below summarises some of the economic and digital indicators for Ireland.

**Table 3: General economic and digital indicators for Ireland**

	% GDP from manufacturing	% GDP growth	DESI position – and change	DESI sub-indicators Human Capital, Use of Internet, Integration of Digital Technology in 2018
Ireland	36.1% in 2017	25.1% (2015) 5% (2016) 7.2% (2017)	6 <sup>th</sup> (2018) 9 <sup>th</sup> (2017) (three places higher compared to 2017)	<ul style="list-style-type: none"> <li>Human Capital: 9<sup>th</sup> (three places lower compared to 2017)</li> <li>Use of Internet Services: 15<sup>th</sup> (one place higher compared to 2017)</li> <li>Integration of Digital Technology: 3<sup>rd</sup> (one place lower compared to 2017)</li> </ul>

## 1.2 National digitisation strategy

The table below presents an overview of the main national strategy to digitise businesses and society.

**Table 4: National Digital Strategy**

Name	Doing more with Digital (2013) 'Phase 1 – Digital Engagement' <sup>9</sup>
Type	Horizontal strategy
Starting date	2013
Objective	The main focus of the National Digital Strategy (NDS) called 'Doing more with Digital' was developing a foundation step to help Ireland to reap the full rewards of a digitally enabled society.
Ministry/ministries in charge (website, contact person)	Department of Communications, Climate Action & Environment (DCCAE) <a href="https://www.dccae.gov.ie/en-ie/communications/topics/Digital-Strategy/Pages/default.aspx">https://www.dccae.gov.ie/en-ie/communications/topics/Digital-Strategy/Pages/default.aspx</a>
Scope of the strategy/action plan	The Strategy set out a vision and a number of practical actions and steps to encourage and assist more citizens and small businesses to get online. Phase 1 focused on Business & Enterprise, Citizen Training and Schools & Education.
Measures included in the strategy/action plan	The specific measures which this strategy (2013) committed to implementing can be grouped under the following headings. The initial targets were set for the first two years of the strategy. <ul style="list-style-type: none"> <li>• Cross –Government measures</li> <li>• Trading online and Entrepreneurship</li> <li>• Citizen Engagement</li> <li>• Education &amp; Learning</li> </ul>
Overall funding and distribution by volume and source of funding (public/private, EU/national)	EUR 27 million (between 2013 and 2018); public funding.

### **Implementation status and challenges**

The **National Digital Strategy (NDS) - 'Doing More with Digital'** launched in 2013 is a foundation to enhance Ireland's capability to become a fully digitally enabled society. The strategy was implemented by the Department of Communications, Climate Action and Environment and was a part of the Government's plan to boost digital adoption and engagement of Irish businesses and citizens. This strategy aims to drive digital adoption in three areas: enterprise, citizens and education. There are a number of complementary national measures, such as the National Broadband Plan, Future Jobs Ireland 2019<sup>10</sup>, the eGovernment Strategy and the eHealth strategy (part of the National Development Plan 2018-2027).<sup>11</sup> Enterprise 2025 Renewed (a national enterprise policy that also targets the adoption of disruptive technologies) and Future Jobs Ireland 2019 (in which two of the main pillars are embracing innovation and enhancing digital skills) aim for Ireland to become a European leader in the digital economy by ensuring a coordinated governmental approach towards the digitalisation of industry and the improvement of SMEs productivity.

Phase 1 of the NDS 'Doing More with Digital' focused on Trading Online and Entrepreneurship for indigenous businesses, More Citizen Engagement and Education and eLearning. There have been several initiatives put in place within Pillars 2, 3 and 5 of the DEI initiative, which will be discussed in detail in the further sections of the report.

Following Ireland's previous National Digital Strategy which focused on *Doing more with Digital*, six years on, the new National Digital Strategy will seek to take full advantage of the evolving opportunities of digital transformation, and deal with the many challenges thrown up by the swift pace of technological advancement.

The Strategy, which is currently at an advanced stage of development, is being led as a shared effort by the Department of the Taoiseach; the Department of Communications, Climate Action and Environment; the Department of Business, Enterprise and Innovation; and the Office of the Government Chief Information Officer in the Department of Public Expenditure and Reform.

A Framework for developing the new National Digital Strategy, was approved by Government in July. It focused on a number of key pillars incorporating: Digital Foundations; Trust, Society and Wellbeing; Effective Use of Digital; and the Digital Economy & Labour Market.

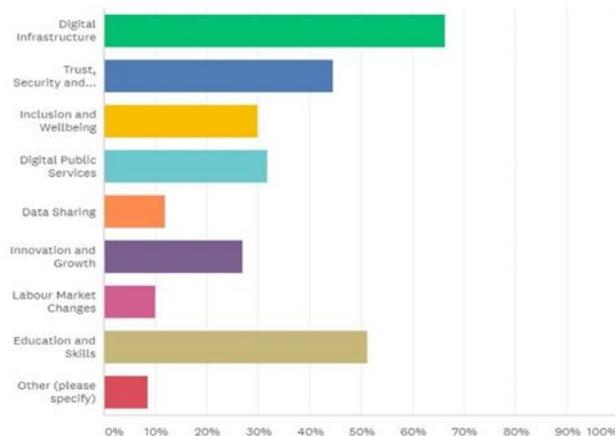
A Public Consultation, to allow members of the public and stakeholders to influence the development of the Strategy, took place in the fourth quarter of 2018. Over 300 responses were received and the chart in figure 4 below summarises the most commonly identified themes. In parallel, wide ranging consultations with stakeholders and sectoral experts to inform development of the Strategy took place.

The final Strategy will provide an overarching long-term vision for how Ireland can best respond to digitalisation.

**Figure 4: Public Consultations on the New Digital Strategy**

What are the most important areas the Strategy should focus on? (please pick a maximum of three)

Answered: 267 Skipped: 0



Source: Government input (2019)

Additionally, the development of a new strategy is underway in relation to digitalisation of manufacturing called '**An Industry 4.0 Strategy for Ireland**'. The aim of the Industry 4.0 strategy is to provide the opportunity for enterprises to undertake Industry 4.0 transformation so as to realise a competitive, innovation-driven manufacturing sector and supply chain in Ireland that is at the forefront of Industry 4.0 adoption and development. The Strategy is expected to be published in the second quarter of 2019. Moreover, the development of a national Strategy on

Artificial Intelligence (AI) will seek to build on the existing AI eco-system in Ireland, leveraging the National Digital Strategy, the EU AI Coordinated Plan and the outputs of the EU High Level Expert Group on AI.

According to the European Smart Specialisation Platform, Ireland's smart specialisation strategy focuses on the following priority domains:

- Manufacturing & industry
- Information & communication technologies
- Energy production & distribution
- Human health & social work activities
- Key Enabling Technologies

The Irish smart specialisation strategy is in line with the National Research Prioritisation Strategy with the main objective to simulate private research and innovation expenditure (digital transformation, service innovation, advanced manufacturing etc.).<sup>12</sup>

Finally, Supporting Advanced Manufacturing in Ireland is highlighted as a specific priority action in Project Ireland 2040: Investing in Business, Enterprise and Innovation 2018-2027.<sup>13</sup> Based on government feedback, there are plans to further scale the network of research and technology centres operating in this space. This includes building on existing capacity (Irish Manufacturing Research and the SFI Centres iForm and CONFIRM, see Section 2.1). An additional large-scale centre for technology development, demonstration and training in areas of discrete manufacturing has also been proposed and is currently under consideration.

### **1.3 EU cooperation in the field of digitising industry initiatives**

According to government representatives' feedback, Ireland is involved in various European projects run under the umbrella of the following European initiatives:

- EU Joint Multi Stakeholder Platform (MSP) on ICT Standardisation
- The Joint MSP/DEI Working Group on standardisation in support of Digitising European Industry
- ICT Innovation for Manufacturing SMEs (I4MS) via Irish Manufacturing Research
- Electronic Components and Systems for European Leadership (ECSEL)

The cooperation with these initiatives focuses on RD&I: High Performance Computing (HPC), Big Data, Cybersecurity, Factory of the Future (FoF), Photonics, Robotics, 5G and International Standards Development through initiatives such as DEI and the EU BRIDGIT2 Project. Internationalisation of standards plays a very important role for Ireland and the involvement of the National Standards Authority (NSAI) of Ireland is vital.

Below some of the benefits indicated by national authorities from these projects in the field of RD&I and International Standards Development:

- Participating in these initiatives is beneficial to Irish organisations when it comes to networking, setting the future strategic research agendas and building consortia for future calls for proposals.
- Collecting insights into DEI initiatives in other EU countries, particularly around standardisation as an enabler for DEI and integration of RDI and standardisation activities.
- Exchanging experiences and best practices on the key topics of industry 4.0.

- Best practices on how other NSBs (National Standards Bodies) across Europe (for example DIN, UNE, NEN) integrate Standards Development & RDI activities for national and EU impact.
- Collecting insights into proposed new ideas on how to enable the digital transformation of European standards development processes and how to potentially integrate open source and standards development.

Some of the challenges indicated by national authorities in the field of RD&I and International Standards Development include the following:

- In some cases, gaining access to certain RD&I initiatives can be perceived as being challenging.
- FoF projects targeting large budgets are a challenge for small Member States like Ireland. There are only a handful of organisations that can coordinate bids of EUR 15-20 million EC contribution. Ireland would advocate for smaller size projects as it is yet to be proved how large budgets have larger impact than smaller projects in this area.
- In ECSEL, there is a whole range of different national rules that have to be adhered to.
- It is difficult to deploy resources (time, effort, funding required), which are in general limited, to research projects.

Opportunities mentioned in the field of RD&I and International Standards Development include:

- Increasing the number of info days and brokerage events channelled through the European Technology Platforms (ETP) to ETPs members and non-members. ETPs could also consider developing a budget for a roadshow in several Members States to promote activities of PPPs.
- Closer collaboration between EU Industry Groups and National representatives in technology and policy areas.
- Online European wide networking and collaboration platform development to help identify and address digital technology and standardisation gaps.
- Funding to incentivise and enable experts (SMEs and researchers from national RDI centres) to proactively engage in international standards development with fellow international experts.

## **2 Other policy support to digitising industry**

### **2.1 Boosting innovation capacity**

The table below presents an overview of the main initiatives to boost innovation capacity (pillars 2 and 3 of the DEI).

**Table 5: National initiatives to boost innovation capacity (Pillars 2 and 3 of the DEI)**

Name	SFI Research Centres <sup>14</sup>	IDA Ireland and Enterprise Ireland Technology Centres <sup>15</sup>	Investment Programme of the National Digital Research Centre <sup>16</sup>	IDA Ireland and Enterprise Ireland Technology Gateways <sup>17</sup>	Pervasive Nation Testbed <sup>18</sup>
Type	RD&I Centre	Technology Centres DIH	DIH	Technology Gateways	Testbed
Starting date	2013	2010	2007	2013	2016
Objective	SFI 17 Research Centres are making important scientific advances, enhancing enterprise and industry, training students with critical, in-demand skills, supporting regional development, and enhancing Ireland's international reputation. Among the key projects in the area of Advanced Manufacturing launched in 2017 recently are Confirm and I-Form.	The Technology Centre programme is a joint initiative between Enterprise Ireland and IDA Ireland. It allows Irish companies and multinationals to work together on market focused strategic R&D projects in collaboration with research institutions.	NDRC's mission is to create globally scalable companies in the digital sector. NDRC invests at a very early stage using an accelerator model. It provides capital and hands-on support to young Irish companies.	The Technology Gateways supported by Enterprise Ireland are linked to Ireland's Institutes of Technology and provide technology brokerage services to industry in Ireland (in particular SMEs).	The objective of Pervasive Nation is to build an Internet of Things testbed of scale which will become a resource for industry, government and academia, and act as a strong catalyst for Internet of Things research and innovation. Pervasive Nation is a national resource open to any individual, researcher, educational institute, business, or agency seeking to test their IoT idea.
Relevant for Pillar 2 <sup>19</sup> or Pillar 3 <sup>20</sup> or both	Pillar 2 & 3	Pillar 2	Pillar 2 & Pillar 3	Pillar 2	Pillar 2
Short description	There are 17 SFI Research Centres in total – at least 7 of these operate in the area of digital technologies (IForm, Confirm, Lero,	The 10 Technology Centres in the programme are resourced by highly-qualified	NDRC's Investment Programmes offer start-up teams: <ul style="list-style-type: none"> <li>Investment of typically EUR 100,000k per venture with up to 24</li> </ul>	Enterprise Ireland in partnership with the Institutes of Technology has established a nationwide network of	The Pervasive Nation infrastructure uses the latest off-the-shelf LPWAN technologies,

Name	SFI Research Centres <sup>14</sup>	IDA Ireland and Enterprise Ireland Technology Centres <sup>15</sup>	Investment Programme of the National Digital Research Centre <sup>16</sup>	IDA Ireland and Enterprise Ireland Technology Gateways <sup>17</sup>	Pervasive Nation Testbed <sup>18</sup>
	<p>Connect, IPIC, Insight, ADAPT). The mission of the Confirm SFI Research Centre is to support the transformation of the Irish manufacturing sector to a smart manufacturing paradigm. This will enable advanced capabilities for industry in the areas of customer-centred manufacturing, optimised real-time decision-making, increased product quality, product line adaptability, shorter supply chains and new business opportunities.<sup>21</sup></p> <p>The I-Form Advanced Manufacturing SFI Research Centre addresses materials processing research within a manufacturing environment.<sup>22</sup></p>	<p>researchers who provide a unique ecosystem for collaboration in areas identified, by industry, as being strategically important. Technology Centres are organised to respond rapidly to industry defined needs and conduct market-relevant R&amp;D in partnership with collaborating groups of companies.</p> <p>Irish Manufacturing Research (IMR) is an example of the RC participating in the programme<sup>23</sup> that offers manufacturing industry a unique environment to collaborate with peers across all manufacturing sectors.</p> <p>Irish Manufacturing Research is part of a select EU network of I4MS – Regional Manufacturing Digital Innovation Hubs that provide a one-stop-shop for manufacturing companies to access all of the supports they need to become ready for the next generation of digital</p>	<p>weeks working alongside a broad spectrum of start-ups, innovators and investors.</p> <ul style="list-style-type: none"> <li>• Expert mentorship in areas such as Company Financials, Investor Readiness, Marketing, PR and Business Model Innovation.</li> <li>• Weekly workshops and networking with acknowledged thought leaders.</li> <li>• The opportunity to build their connections with the investment community.</li> </ul>	<p>15 Technology Gateways. They deliver technology solutions for Irish industry close to their market needs and are open access points for industry of all sizes. They act as local access points to the wider resources in the Irish research infrastructure. The total value of the projects delivered since 2013 at least EUR 30 million.<sup>24</sup> There are at least 6 gateways relevant for digitalisation (e.g. the CAPP Gateway, the COMAND Gateway, the IMaR Gateway).</p>	<p>software-defined radio and Application Enablement Platform (AEP) technologies. These provide end-to-end connectivity allowing users to shape the future of the Internet of Things. Pervasive Nation is Ireland's Internet of Things testbed operated by CONNECT, the Science Foundation Ireland Research Centre for Future Networks headquartered at Trinity College Dublin, the University of Dublin.</p>

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		<p>manufacturing. They provide information and support to manufacturing SMEs from:</p> <ul style="list-style-type: none"> <li>• Access to key research capacity and skills in Ireland and across Europe</li> <li>• Access to Competence Centres across Europe and Ireland</li> <li>• Access and support in accessing public and private funding</li> <li>• Connectivity to networks of manufacturing companies (SMEs and multinational)</li> <li>• Best known methods and case-studies</li> <li>• Technology roadmaps and frontier technologies</li> <li>• Integration into EU consortia and funding programs</li> <li>• Access to experimental facilities</li> <li>• Connectivity to national funding bodies and authorities</li> </ul>			
Granting organisation	Science Foundation Ireland	Enterprise Ireland (and Industry Contributions)	Department of Communications, Climate Action and Environment	Enterprise Ireland (and Industry Contributions)	Science Foundation Ireland
Participating organisations	The SFI Research Centres create consortia with industry and academic	Technology Centre, Industry, academics	Enterprise Ireland	Ireland's Institutes of Technology	Trinity College Dublin and nine

Name	SFI Research Centres <sup>14</sup>	IDA Ireland and Enterprise Ireland Technology Centres <sup>15</sup>	Investment Programme of the National Digital Research Centre <sup>16</sup>	IDA Ireland and Enterprise Ireland Technology Gateways <sup>17</sup>	Pervasive Nation Testbed <sup>18</sup>
	<p>partner institutions throughout the country. Confirm is based at University of Limerick, Academic Partner Institutions include Tyndall National Institute, University College Cork, Cork Institute of Technology, NUI Galway, Athlone Institute of Technology Maynooth University and Limerick Institute of Technology.</p> <p>I-Form is based at University College Dublin, Academic Partner Institutions include Dublin City University, NUI Galway, Trinity College Dublin, Institute of Technology Sligo, Waterford Institute of Technology</p>				other Irish campuses.
Sectors targeted	Industry partners within the I-Form Centre are involved in a range of sectors, including the manufacture of medical devices, aerospace, automobile, microelectronic components, as well as materials manufacturers and suppliers	Programme is not sector-specific, IMR is a cross-sectoral research centre with partner companies in semiconductors, ICT, pharma, medical devices, food, energy services, aerospace and other areas.	Programme is not sector-specific. Digital technology across multiple sectors from Finance, Environment, business software, health, property, agriculture to travel	Programme is not sector-specific	Programme is not sector-specific

Name	SFI Research Centres <sup>14</sup>	IDA Ireland and Enterprise Ireland Technology Centres <sup>15</sup>	Investment Programme of the National Digital Research Centre <sup>16</sup>	IDA Ireland and Enterprise Ireland Technology Gateways <sup>17</sup>	Pervasive Nation Testbed <sup>18</sup>
Technologies targeted	With regard to digitising industry - Social Media, Cloud, IoT, Cybersecurity, Robotics & Automation, Big Data & Data Analytics, AI, Advanced Manufacturing.	Manufacturing informatics, Operational excellence, Energy management, Energy efficiency, Operations research, Industry 4.0, Additive Manufacturing, Robotics & Automation	All technologies targeted.	All technologies targeted.	Mobile services, IoT, Big Data and Data Analytics, AI
Funding (split by private/public and national/EU), state period/annual funding	Over EUR 63.2 million allocated for 17 Research Centres in 2018  In addition to the SFI funding, the SFI Research Centres (Confirm and I-Form) must obtain 30% of the total Centre budget from industrial co-investment for collaborative research projects. The SFI contribution equates to a maximum 70% of the total Centre funding. In 2019 it is anticipated that over EUR 64.4 million in funding will be allocated to the RCs by SFI.	Public funding from the DBEI of EUR 18.3 million in 2018 for the 10 Technology Centres.  EUR 16.8 million public funding approved between 2015 to date for IMR. Other funding also through additional public competitive funds and private funding.	EUR 14.5 million between 2015 to date	Public funding from the DBEI of EUR 5.7 million in 2018.  Other funding also through additional public competitive funds and private funding.	EUR 1.8 million (Jan-Dec 2016) SFI and co-funded under ERDF
Current status of initiatives	Ongoing	Ongoing	NDRC has invested into 255 companies including Nuritas, Logentries, Bizimply, Newswhip, Tandem and SilverCloud Health. To the end of 2017, NDRC supported companies have raised	Ongoing More than 3,200 industrial projects have been completed since 2013.	

Name	SFI Research Centres <sup>14</sup>	IDA Ireland and Enterprise Ireland Technology Centres <sup>15</sup>	Investment Programme of the National Digital Research Centre <sup>16</sup>	IDA Ireland and Enterprise Ireland Technology Gateways <sup>17</sup>	Pervasive Nation Testbed <sup>18</sup>
			EUR 192 million in follow-on investment and employ almost 1,000 people directly.		

### ***Impacts, challenges and perceptions***

The quantitative indicators available indicate an overall positive result for Ireland with regard to digitalisation, with some areas of improvement. The ICT Spending as a percentage of GDP in Ireland in 2015 was 1.6%. However, there is still room for an increase in funding of digital transformation when comparing the figures with the OECD average ICT spending of 2.3%, as per OECD 2017 data. The evolution of ICT investment as a percentage of total investment was 6.45% in 2015 - which is below the OECD average (11.7%). The total CAPEX spending (as percentage of GDP) increased between 2015 and 2016 from 24% to 36% as per OECD data.

The EC Smart Specialization Platform indicates the following five Digital Innovation Hubs operating in Ireland<sup>25</sup>:

- Centre for Applied Data Analytics and Machine Intelligence, CeADAR
- Insight Centre for Data Analytics
- Irish Manufacturing Research
- Irish Centre for Cloud Computing and Commerce (IC4)
- Tyndall National Institute, Tyndall

In addition to the Hubs outlined above, there are also several research institutes of relevance to the digitisation of industry operating in Ireland. The National Institute for Bioprocessing Research and Training (NIBRT) performs industry-aligned research in biopharmaceutical manufacturing and also provides a “one stop shop” for the bioprocessing Industry’s training requirements. NIBRT are driving the adoption of disruptive Industry 4.0 technologies through their Biopharma 4.0 Alliance. Furthermore, the Irish Centre for High-End Computing (ICHEC) is Ireland’s national high-performance computing (HPC) research and technology organisation, focusing on enabling the effective use of HPC technologies in business and academia. ICHEC operates Ireland’s supercomputer, as well as a number of leading-edge test platforms. Additionally, there is also the Digital Innovation Hub operating since 2003 that provides office space and business support services to growing technology companies. It also provides digital learning and training opportunities to the local community. Since 2015 around EUR 6.5 million has been allocated to the DIH<sup>26</sup>.

The quantitative indicators also indicate Irish companies’ steady performance with regard to digitalisation. Between 2015 and 2017, the number of Irish enterprises that use two or more types of social media has increased. During the same period, the number of Irish companies selling online, and generating at least 1% of their turnover via these sales remained at the level of around 30%. The number of Irish companies doing electronic sales to other EU countries stayed constant.

When comparing the perception of contribution of initiatives to uptake of digital technologies both the government and industry representatives express a similar, rather positive opinion. When asked about the perceived level of innovation in digital industries (ICT, digital platforms) in Ireland compared with the other Member States, the industry perception was 4 and government perception was 3 (on the scale 1 to 5, 1 being low and 5 being high). Both industry and government agree on the score (3 on the scale 1 to 5) regarding the level of take-up of digital technologies by non-ICT industries. In relation to the perceived usefulness of the government support for digital transformation the industry representatives provided an average score of 3 (on the scale 1 to 5).

According to industry associations, the key opportunities in Ireland related to the take-up of digital technologies are:

- Access to collaborative opportunities within Ireland, in particular, disrupted supply chains (in automotive and agro-tech sectors some solutions are being developed).

- NSAI disruptive standards initiatives to expose companies to the emerging technologies and the ways they are gaining traction through access to the ISO/IEC world technical development groups.
- Enhanced productivity across economy would be a key output. Digital transformation presents opportunities for enhancing economic growth and well-being in Ireland.

Key challenges and barriers in Ireland related to take-up in digital technologies that are perceived by industry associations are mainly:

- Particular difficulties for the SME base to take in the high-level information on technologies being promoted and translating the use of these technologies to create value proposals.
- There is a need for case studies that demonstrate application cases that created value and the stages of company journey to implement.
- Companies need the confidence to understand the translation journey to encourage actions towards exploring how the technologies can be applied by them.
- Firms are at different stages (levels/momentum) of digital transformation. There is particularly high productivity gap between SMEs and larger firms.
- There is a need for an enhanced understanding of the digital maturity of enterprise clients and sectors in Ireland.
- There is a need to help enterprises build value propositions for digitalisation. This is not always clear or compelling enough to enable decisions to drive change and investment.
- A significant effort is required to build awareness and encourage engagement with disruptive technologies (e.g. AI in particular) to ensure the enterprise base are not left behind as industry adoption accelerates globally.
- There is a need to increase the volume of SMEs participating effectively in digital technology discovery and evaluation. An evaluation of the industrial supports to aid this aspect is required to identify gaps and implement solutions.
- An evaluation of the creative ideation skills and innovation management skills deficits and programs to build competence, enhance the talent pools that will be required to allow companies to effectively harness digital technology capabilities.

The following actions were proposed by industry associations in order to streamline on the national level the digitalisation process across sectors, industries and enhance the SMEs' digital capabilities:

- Delivering and implementing a national action plan for the digitalisation of enterprises.
- Nurturing digital innovation and fostering digital entrepreneurship.

Following the take-up of digital technologies, an increased productivity and new areas of growth are expected by the government, which will have in the short and long-term a positive impact on Ireland's economy. The key challenges and barriers are linked to firms' limited awareness and understanding of the changes and digital solutions available. There is also a shortage of ICT-specialists and access to finance.

Overall, the initiatives launched within Pillar 2 & 3 started a while ago within the 'Doing more with Digital (2013)' National strategy focus on digitalisation within the Irish population in general. There are also several new initiatives launched in 2017 and 2018 (some selected ones presented in the table 5) that focus on manufacturing and digitalisation of various sectors and industry digitalisation, which are in line with the DEI objectives.

The Department of Business, Enterprise and Innovation will develop a pilot with a view to addressing the difficulties SMEs often have in accessing loans for investments in digital

technologies from financial institutions. Furthermore, and in line with the Public Spending Code, this pilot will help gauge demand for, and assist in the formulation of, longer-term strategic financing options for digital investments.

## **2.2 Regulatory framework for digital age**

The table below presents the main initiatives related to a digital regulatory framework (Pillar 4 of the DEI).

**Table 6: Main initiatives to establish a regulatory framework (Pillar 4 of the DEI)**

Name	Digital Hub Development Agency Act 2003 <sup>27</sup>	National Cyber Security Strategy <sup>28</sup>
Type	DIH Regulation	National strategy on cybersecurity
Starting date	2003	2015, to be updated in 2019
Objective	The Act defines the functions of the Agency, staffing of Agency and the responsibilities of the Board of the Agency including accounting and reporting duties. The Act also sets out the Dissolution of Digital Media Development Limited and their transitional provisions.	The Strategy is a high-level policy statement from Government. It acknowledges the challenges with facilitating and enabling the digital economy and society and is a response to key risks arising nowadays.
Short description	An act to provide for the establishment of a Body to be known as the Digital Hub Development agency, to define its functions, to dissolve Digital Media Development Limited, to amend the Communications Regulation Act 2002 and to provide for Connected Matters.	<ul style="list-style-type: none"> <li>• Formally establishing the National Cyber Security Centre, encompassing the national/governmental Computer Security Incident Response Team (CSIRT-IE), its focus is on the protection of critical national information infrastructure in key sectors such as energy and telecommunications.</li> <li>• Delivering improved security arrangements, in partnership with Government Departments and Key Agencies involving situational awareness and incident management.</li> <li>• Introducing primary legislation to formalise arrangements in law and to comply with EU requirements on capabilities, cooperation and reporting.</li> <li>• Cooperating with key State Agencies, industry partners and international peers in the interests of protecting critical infrastructure, improving situational awareness and incident management along with facilitating education, training and public awareness initiatives.</li> </ul>
Sectors targeted	No specific sector	IT security

### ***Impacts, challenges and perceptions***

Overall, industry associations consider the regulatory framework applying in Ireland moderately fit for the digital age (score of 3 on a scale of 1-5, 1 being low and 5 being high). They recognise that there have been some improvements to the regulatory framework making it more fit for the digital age, however further changes need to take place for specific digital features.

The General Data Protection Regulation came into effect across the EU on 25 May 2018. The Data Protection Act 2018 was enacted in the same month and gives effect to the limited areas of flexibility permitted under the Regulation. According to a representative from the Data Protection sector, data protection compliance provides a good framework for management of digital information assets. The Network and Information Security Directive (NIS) was transposed by SI 360 of 2018 on 18th September 2018 into Irish law. The Public Consultation Document in respect of the 2019 National Cyber Security Strategy was published on 19th March 2019. As per the requirements of Regulation 11(4) of S.I. 360 of 2018, the public consultation will be open for 30 working days with a closing date of 1st May 2019. The objective behind the National Cyber Security Strategy process is to produce a broad-based document with ownership from across Government and input from both general and specialist expertise in the subject. The public consultation process is designed to elicit the views of the general public and the views of those with an interest in the subject, such as specialists in the field of Cyber Security. The various components of the Public Consultation have been designed to deliver a strategy document that not only meets the EU Network and Information Security Directive requirements in relation to a National Cyber Security Strategy, but also fully comprehends the wider issues and opportunities associated with Cyber Security Strategies in general. Finally, there are currently 30 legislative proposals related to the Digital Single Market, which will lead to future initiatives development in relation to digitising industry.

When asked whether the Irish authorities have taken specific initiatives e.g. regulatory testbeds to assess the effects of the regulatory climate on innovation and digital transformation, one industry association representative indicated that some State Agencies and Government Departments are currently working cross functionally to address new market developments and digital trends such as Fintech (Financial Technology). Furthermore, some initiatives are also under development by the National Standards Authority of Ireland (NSAI) linking into International Standardisation in order to map key issue required for suitable regulation (e.g. Cyber Security Standardisation). It is permitted in Ireland to account for digital investments as capex. This is required for essential first steps in cloud adoption, Middleware and ERP systems to allow multiple platforms to communicate.

Some challenges remain in the regulatory landscape in Ireland. Although the legislation leading to the establishment of the Digital Hub is beneficial for the low volume of start-ups with collaborative benefits, there is a problem of scalability. The current Cybersecurity Strategy addresses some aspects of digital transformation, but it needs to still incorporate issues such as cloud adoption, sensor utilisation, data management and analytics, standard development etc. The main regulatory barriers mentioned by industry association are awareness and understanding of universal communication protocols, data transfer and categorisation and GDPR compliance.

### **2.3 Skills development**

The table below presents an overview of the main measures for digital skills development (Pillar 5 of the DEI).

**Table 7: Main initiatives to develop digital skills (Pillar 5)**

Name	Springboard+ <sup>29</sup>	'Digital Skills for Citizens' Grant Scheme <sup>30</sup>	EXPLORE Programme <sup>31</sup>	Technology focused Skillnet networks <sup>32</sup>	School Digital Champion Programme <sup>33</sup>
Type	Training	Training	Training	Training	Training
Starting date	2011	2016	2018 pilot	2005	2015
Objective	To provide upskilling and reskilling courses to develop the talent base in Ireland in key growth sectors of the economy. The initiative's primary target group when it was established in 2011 was unemployed people with a previous history of employment. Over recent years with the decline in numbers on the live register the focus was changed to include more people in employment.	To bridge the digital divide and provide all citizens with the opportunity to get online.	The EXPLORE programme is designed to address the need for enhanced transversal and digital skills among older workers in manufacturing sectors.	Technology Ireland ICT Skillnet is a network of companies who collaborate to address skills needs within the technology sector.	To encourage students to productively use their digital skills and provide a link to industry to encourage careers in ICT.
Short description	Springboard+ which now also incorporates the ICT skills conversion programme, began in 2011 as part of the Government's Jobs Initiative. It complements the core State-funded education and training system and provides free or 90% funded upskilling and	The Department's 'Getting Citizens Online' Programme focuses on supporting and empowering citizens to participate fully in Ireland's digital economy and society. The Programme includes the 'Digital Skills for Citizens' scheme. This scheme provides digital skills training for citizens who do not have the skills or	The key objective of EXPLORE is to create a potential new solution to help address the issue of Ireland's low level of participation in lifelong learning amongst the Irish workforce, targeting particularly persons over 35 years of age in manufacturing employment to improve transversal and digital skills.	The network is a non-profit body which is co-funded by Skillnet Ireland, the national agency for workforce development learning, and the member companies. Technology Ireland ICT Skillnet has trained in excess of 4,000 staff ensuring that Irish ICT companies remain competitive and prepared for advanced	The School Digital Champion Programme was launched as part of the National Digital Strategy to promote digital adoption and encourage the productive use of technology by students. The programme is creating an interest in STEM and developing an aptitude for digital and ICT at all levels in secondary schools. The programme is providing students with a platform to drive digital

Name	Springboard+ <sup>29</sup>	'Digital Skills for Citizens' Grant Scheme <sup>30</sup>	EXPLORE Programme <sup>31</sup>	Technology focused Skillnet networks <sup>32</sup>	School Digital Champion Programme <sup>33</sup>
	reskilling higher education opportunities in areas of identified skills need.	confidence to use the internet with a view to removing a key barrier to digital adoption.		and emerging technologies. In 2019 the network amalgamated with the Technology Ireland Innovation Forum to provide a new focus and range of services to the shared membership of both groups in the innovation space.	adoption outside the walls of the classroom by connecting with local enterprises and the wider community.
Granting organisation	Department of Education and Skills	Department of Communications, Climate Action and Environment (Irish Government)	Department of Education and Skills	Department of Education and Skills	Department of Communications, Climate Action and Environment (Irish Government)
Participating organisations	Springboard+ is delivered in public and private education facilities around the country.	Following a competitive call for proposals, 12 Community Voluntary not-for-profit organisations are funded to provide training.	Education and Training Boards and Private Employers.		Post Primary Schools
Sectors targeted	ICT, Engineering, Manufacturing, Medical Devices, Construction; Hospitality, Business, Administration, Entrepreneurship and Animation.	All	All sectors that have manufacturing as part of their business.	All	All

Name	Springboard+ <sup>29</sup>	'Digital Skills for Citizens' Grant Scheme <sup>30</sup>	EXPLORE Programme <sup>31</sup>	Technology focused Skillnet networks <sup>32</sup>	School Digital Champion Programme <sup>33</sup>
Funding (split by private/public and national/EU), state period/annual funding	EUR 112.4 million available for between 2015 and 2018 (source: National Training Fund)	EUR 4.2 million to end Feb 2019 (source: National Government)	EUR 0.75 million (source: National Training Fund)	N/A	N/A
Current status of initiatives	Ongoing	First grants awarded in December 2016, training commenced in 2017	256 people participated in the EXPLORE pilot initiative during 2018. EXPLORE will be rolled out nationally during 2019 and it is expected that over 500 employees will participate in the initiative. It is planned that the EXPLORE initiative will be independently evaluated during 2019.	Ongoing	Ongoing

### ***Impacts, challenges and perceptions***

There are several training programmes within Pillar 5 that have been introduced in Ireland aiming at improving the digital skills of the Irish citizens. Overall, the industry association's feedback regarding the developments within Pillar 5 is positive. When asked about the improvements of workforce's digital skills since 2015, the feedback was on average 3 (on the scale 1-5 where 1 is low and 5 is high). Similarly, the perception of usefulness of government initiatives on digital skills was evaluated positively, with the score 4 (on the scale 1-5). Regarding the metrics measuring digital skills gaps, the following feedback was provided by the government representatives:

- For higher level ICT skills, labour market intelligence on vacancies/skills shortages developed by Ireland's Skills and Labour Market Research Unit in Solas
- Regional Skills intelligence gathered by Regional Skills Fora managers
- ICT/digital skills surveys undertaken as part of work of Expert Group on Future Skills Needs
- Findings of National Employer Survey undertaken by Higher Education Authority and SOLAS.

Irish authorities indicated that they collect employers' feedback in order to monitor the link between development of initiatives within Pillar 5 and the improvement of digital skills. They indicated that evidence is collected as part of the National Employer Survey (undertaken by Higher Education Authority and SOLAS) as well as a qualitative survey research undertaken by the Expert Group on Future Skills Needs (ICT Skills Demand Forecast studies). The predictions of the latest forecasts (March 2019) indicate the difficulty for the education sector in meeting the rate of growth in demand for ICT specialists. This report was a key input into the development of the third ICT Skills Action Plan, called 'Technology Skills 2022'. This contains 22 actions is expected to reduce the mismatch between the demand and supply within the Irish population.<sup>34</sup> Additionally, Skillnet Ireland plays an important role in supporting the Technology Skills 2022 Action Plan, which includes the development of AI programmes, such as Ireland's first Masters in Artificial Intelligence in cooperation with the University of Limerick.

### **Basic Digital Skills**

The development of basic digital skills in the broader population is important as it enables inclusion in a digital era. Nearly half of the adult population is lacking at least basic digital skills, being an area of weakness within the country. In terms of the use of online services, Ireland remains broadly comparable to the EU average.

### **Advanced digital skills**

Ireland is a European leader in terms of the relative proportion of STEM graduates, with results highly exceeding the EU average. It is also slightly above the EU average in its proportion of ICT specialists in the overall workforce. However, Ireland is experiencing a shortage of ICT specialists. This was also indicated by the industry's feedback. Demand for higher end ICT skills is forecast to grow significantly over the coming years, according to research undertaken by Ireland's Expert Group on Future Skills Needs. This will be driven by market demand and the spread of digitalisation across all sectors of the economy. Almost a third (32%) of Irish SMEs surveyed would welcome some sort of digital/e-commerce training, as indicated in the Digital Health Index (2017)<sup>35</sup>.

There will be an increase in demand for higher end ICT skills to 13,000 potential job openings in the current year (2019). Overall, over the period 2018-2022, there is forecast to be almost 73,000 potential job openings for high end ICT professionals – this is far higher than the demand experienced over the previous four-year period.

## **Employability skills**

Digital transformation will change the future of work. Ibec's (2018) research indicates that:

- Ireland's lifelong learning rate is less than half the benchmark set by the EU and significantly below what is required by a knowledge-based economy.
- Employers are generally satisfied with graduates' range of skills, but less than 45% are satisfied with graduates' entrepreneurial and business acumen skills. On the other hand, the Higher Education Authority's National Employer Survey 2018 indicates that satisfaction with entrepreneurial skills is at 66% for Higher Education Graduates and 68% for Further Education Graduates, whereas "commercial awareness" is at 71% for Higher Education and 74% for Further Education and Training.
- Over 75% of employers were confident of graduates having the academic knowledge, but less confident about graduates having the right attitude and aptitude towards work. Having said that, the National Employer Survey 2018 shows very high satisfaction rates with both workplace and personal attributes of graduates. Overall satisfaction rates with graduates were at 86% for Higher Education and 84% for Further Education and Training.

The Action Plan for Education 2018 places emphasis on increasing participation in lifelong learning. The Plan envisages that Ireland's lifelong learning participation rate should increase to 10 per cent by 2020 and 15 per cent by 2025.

## **2.4 Support mechanisms**

### ***Disruptive Technologies Innovation Fund***

The Disruptive Technologies Innovation Fund is a EUR 500 million funds established under Project Ireland 2040 and is run by the Department of Business, Enterprise and Innovation with administrative support from Enterprise Ireland. Under the first call (2018), 27 projects were successful and approved for funding, among them many led by start-ups and SMEs<sup>36</sup>. They represent sectors in Ireland such as health, food, ICT and manufacturing. The successful projects will receive over EUR 70 million to 2021.

The Fund is worth EUR 20 million in 2019, EUR 30 million in 2020, EUR 40 million in 2021 and EUR 90 million in 2022. The main areas targeted are: robotics, AI, augmented and virtual reality, advanced manufacturing and smart and sustainable food production.<sup>37</sup>

### ***Trading Online Voucher Scheme<sup>38</sup>***

The Trading Online Voucher Scheme assists small businesses to trade online. Eligible businesses can apply for a voucher to invest in developing their ecommerce capability, of up to EUR 2,500 matched by own funding to develop a trading online component to their business. Over 5,200 businesses have successfully applied for funding under the Scheme since its launch in 2014. Furthermore, circa 15,000 businesses have benefited from training under the Scheme in that time. The total amount of public funding for the initiative between 2014-2018 is EUR 8.4 million.

### ***Enterprise Ireland RD&I Support Mechanisms<sup>39</sup>***

Enterprise Ireland supports and de-risks RD&I either by supporting companies to undertake RDI within the company, by collaborating with Higher Education Institutions (HEIs), or by sourcing/licencing new technologies from HEIs which can provide a step change in their innovative capabilities. At the same time Enterprise Ireland has supports in place to help

companies maximise the funding they can receive from the European Union. Enterprise Ireland supports in this area include:

- **Exploring Innovation:** Projects typically up to EUR 75,000 with 50% support to aid companies to explore and plan to alleviate the technical and commercial risks of challenging projects before embarking on significant development projects.
- **RD&I Supports:** RDI Funding Supports for Irish businesses help companies with the development of new and/ or improved products, processes and/ or services to grow their sales and employment. These supports include the Agile Innovation Fund; the Research and Development (R&D) Fund, the Business Innovation Initiative and the Intellectual Property (IP) Strategy.
- **Operational Excellence:** will allow a company to apply for support towards a bundle of Capital Investment, Training and Business Innovation Initiative (BII) funding in a combined project addressing major aspects of implementing a Digital transformation project covering capital costs of technology acquisition, training costs to support the people issues associated with changing organisation structures and operational tasks and the BII to support the development of new services, operational processes and/or business models associated with the developments.
- **Innovation Vouchers:** worth EUR 5,000 to small businesses to introduce them to innovation, linking them with a network of knowledge providers. Vouchers encourage companies and public knowledge providers to work together on specific innovation questions and projects related to the company's needs.
- **Innovation Partnerships:** help industry to engage in collaborative research projects with Irish universities and Institutes of Technology to develop new products and services. The participating company benefits in terms of its growth, the evolution of its strategic research and development and the creation of new knowledge that it can use to generate commercial advantage.

### 3 Conclusions

The following table provides an overview of how the different digitalisation initiatives implemented in Ireland have been funded.

**Table 8: Breakdown for the financing of the initiatives**

	Pillar 2	Pillar 3	Pillar 4	Pillar 5
	Digital Innovation for all	Partnerships and industrial platforms	Regulatory framework for digital age	Preparing for digital future (skills)
Investment Plan of the National Digital Research Centre	EUR 14.5 million (2015 to date)			
IDA Ireland and Enterprise Ireland Technology Centres	EUR 18.3 million (in 2018)			
IDA Ireland and Enterprise Ireland Technology Gateways	EUR 5.7 million (in 2018)			
SFI Research Centres	EUR 63.2 million (in 2018)			
Pervasive Nation – IoT Testbed	EUR 1.8 million (Jan-Dec 2016)			
Digital Hub Development Agency Act			N/A	
National Cyber Security Strategy			N/A	
Technology focused Skillnet networks				N/A
'Digital Skills for Citizens' Grant Scheme				EUR 4.2 million (2016 to date)
School Digital Champion Programme				N/A
Springboard+				EUR 112.4 million (2015 to 2018)
'EXPLORE Programme				EUR 0.75 million (2018)
Disruptive Technologies Innovation Fund	Start of funding in 2019 (EUR 20 million)			
Trading Online Voucher Scheme	EUR 8.4 million (2014-2018)			
Enterprise Ireland RD&I Support Mechanisms	EUR 78.7 million (in 2018)			
<b>Total spending</b>	<b>At least EUR 308 million</b>			

To sum up, there have been several initiatives launched at a national level and within the DEI pillars in Ireland, with new strategies in the pipeline for 2019. There is a high level of commitment from the government and industry to design and coordinate initiatives at a national level, which is demonstrated through national consultations, working groups and involvement of the key stakeholders in the strategy shaping. Ireland's overall performance is positive among the EU Member States when it comes to digitalisation and it belongs to the high-performing cluster of countries. Ireland has been ranked 6<sup>th</sup> according to the Digital Economy and Society Index (DESI) in 2018, which is an increase of three places in the ranking compared to 2017. This is due to an

improvement in each of the five DESI dimensions. Ireland performs above the EU average in all dimensions.

2019 will see the publication of a new National Digital Strategy that incorporates extensive consultations and builds on existing digital strategies and initiatives to move Ireland to the next phase of digital transformation. Additionally, the development of a new strategy is underway in relation to digitalisation of manufacturing called 'An Industry 4.0 Strategy for Ireland', which will support the digital transformation in the manufacturing sector and its supply chain in Ireland. The development of a national Strategy on Artificial Intelligence will play a significant part in achieving the aims of the Digitising European Industry initiative.

There are numerous ongoing initiatives within Pillars 2 & 3 – some of them were launched a while ago within the 'Doing more with Digital (2013)' National Digital Strategy. There are also several new initiatives that have been launched recently (e.g. additional SFI research centres, Irish Manufacturing Research DIH) that focus specifically on manufacturing and digitalisation of various sectors and industry digitalisation with the use of technology. Some of the initiatives, such as the Investment Programme of the National Digital Research Centre, target start-ups and SMEs that lag behind larger companies in terms of digitisation level and use of modern technologies. This is an important step as productivity and digitalisation gap between SMEs and corporations in Ireland prevail.

The overall impression is that there is improvement in the regulatory landscape (Pillar 4) of Ireland. Having said that, there is a need to update the existing regulatory framework to incorporate issues such as cloud adoption, sensor utilisation, data management and analytics to mention a few. This is particularly important as the new business models emerge and are not always fully within the framework of the current regulation. The National Cyber Security Strategy is due to be updated in 2019.

There are several ongoing training programmes within Pillar 5 that have been introduced in Ireland aiming at improving the digital skills of the Irish citizens and addressing the most pressing issues within the population. The initiatives within Pillar 5 are very important for Ireland, with over half of the adult population lacking basic digital skills and the country experiencing a shortage of ICT specialists. Ireland's Third ICT Skills Action Plan 'Technology Skills 2022' being a joint effort of the government and key stakeholders is part of the long-term strategy focusing on boosting skills of the Irish population.

The box below presents a good practice for Ireland.

### **Box 1: Good practice**

#### **Disruptive Technologies Innovation Fund**

The Disruptive Technologies Innovation Fund is a EUR 500 million fund established under Project Ireland 2040 and is run by the Department of Business, Enterprise and Innovation with administrative support from Enterprise Ireland. The Fund will drive collaboration between Ireland's research base and industry to develop disruptive technologies and applications on a commercial basis, as well as facilitating enterprises to compete directly for funding in support of the development and adoption of these technologies. Under the first call (2018) 27 projects were successful and approved for funding, among them many led by start-ups and SMEs. They represent sectors in Ireland such as health, food, ICT and manufacturing. The successful projects will receive over EUR 70 million to 2021. The growing interest in the participation in the programme and the positive tendency in the budget allocation for the following years demonstrates the successful set up and future potential of the fund. Based on

national authorities' feedback, the Disruptive Technologies Innovation Fund constitutes good practice in Ireland that can also be introduced in the other Member States.

To conclude, the table below provides a general overview of the main digitalisation initiatives implemented in Ireland, the level of take-up and perception of their impacts as well as the overall progress the country has made so far with regards to digitalisation.

**Table 9: Total input-output overview**

		Pillar 2	Pillar 3	Pillar 4	Pillar 5
		Digital Innovation for all	Partnerships and industrial platforms	Regulatory framework for digital age	Preparing for digital future (skills)
Application	Name of key initiatives (starting date in brackets)	- IDA Ireland and Enterprise Ireland Technology Centres (2010) - IDA Ireland and Enterprise Ireland Technology Gateways (2013) - Pervasive Nation: IoT Testbed (2016)	N/A	- Digital Hub Development Agency Act (2003) - National Cyber Security Strategy (2015)	- Technology focused Skillnet networks (2005), - 'Digital Skills for Citizens' Grant Scheme (2016), - School Digital Champion Programme (2015), - Springboard+ (2011) - EXPLORE Programme (2018)
		- Investment Plan of the National Digital Research Centre (2007)			
		- SFI Research Centres (2013)			
	Funding	Around EUR 103.5 million (between 2015 to date)			Around EUR 117.4 million (2015 to date)
	Industries addressed	All	All	All	All
	EU programme involved	N/A	ERDF	N/A	N/A
Usage	Perception of initiative	Government support is considered as rather useful (3/5) for digital transformation		The regulatory framework is perceived to be better fit (3/5) for digitalization than previously	The government initiatives on digital skills are perceived as useful (4/5)
	Take-up	5 DIHs	N/A		N/A
Outcomes	Perception of outcomes	The level of take-up of digital technologies is perceived as moderate (3/5)	The level of innovation in digital industries is perceived as elevated (4/5)	The regulatory framework is perceived to be relatively fit for the digital age (3/5)	N/A
	Outcome metrics	Total DESI 6 <sup>th</sup> (2018) vs. 9 <sup>th</sup> (2017)		The total CAPEX spending (as percentage of GDP) increased between 2015 and 2016 from 24% to 36%.	The number of people employed with ICT specialist skills increased by 20% between 2015 and 2017. In the same period, the share of enterprises providing training to develop ICT skills remained at 30%.
	Change in outcomes	Within the DESI Integration of Digital Technology sub-index Ireland is ranked as 3 <sup>rd</sup> in DESI 2018, one place lower compared to 2017.			
End-goal	Productivity growth	Real labour productivity growth per person employed in Ireland was 20.9% in 2015, 1.2% in 2016 and 2.1% in 2017 (Eurostat)			
Summary		Ireland has recently launched a number of initiatives with focus on pillar 2,3 and 5 and the impact of the initiatives is monitored by the national authorities. A new National			

Digital Strategy, an Industry 4.0 strategy, a national AI Strategy and other initiatives under Pillar 4 are currently in development.

## ANNEX 1 List of stakeholders interviewed

Type of stakeholder	Name of organisation
Government representative	Department of Business, Enterprise and Innovation (DBEI)
Government representative	Department of Education and Skills (DES)
Agency of Government Department	Enterprise Ireland (EI)
Industry association	Association of Data Protection Officers (ADPO)
Industry association	Ibec

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