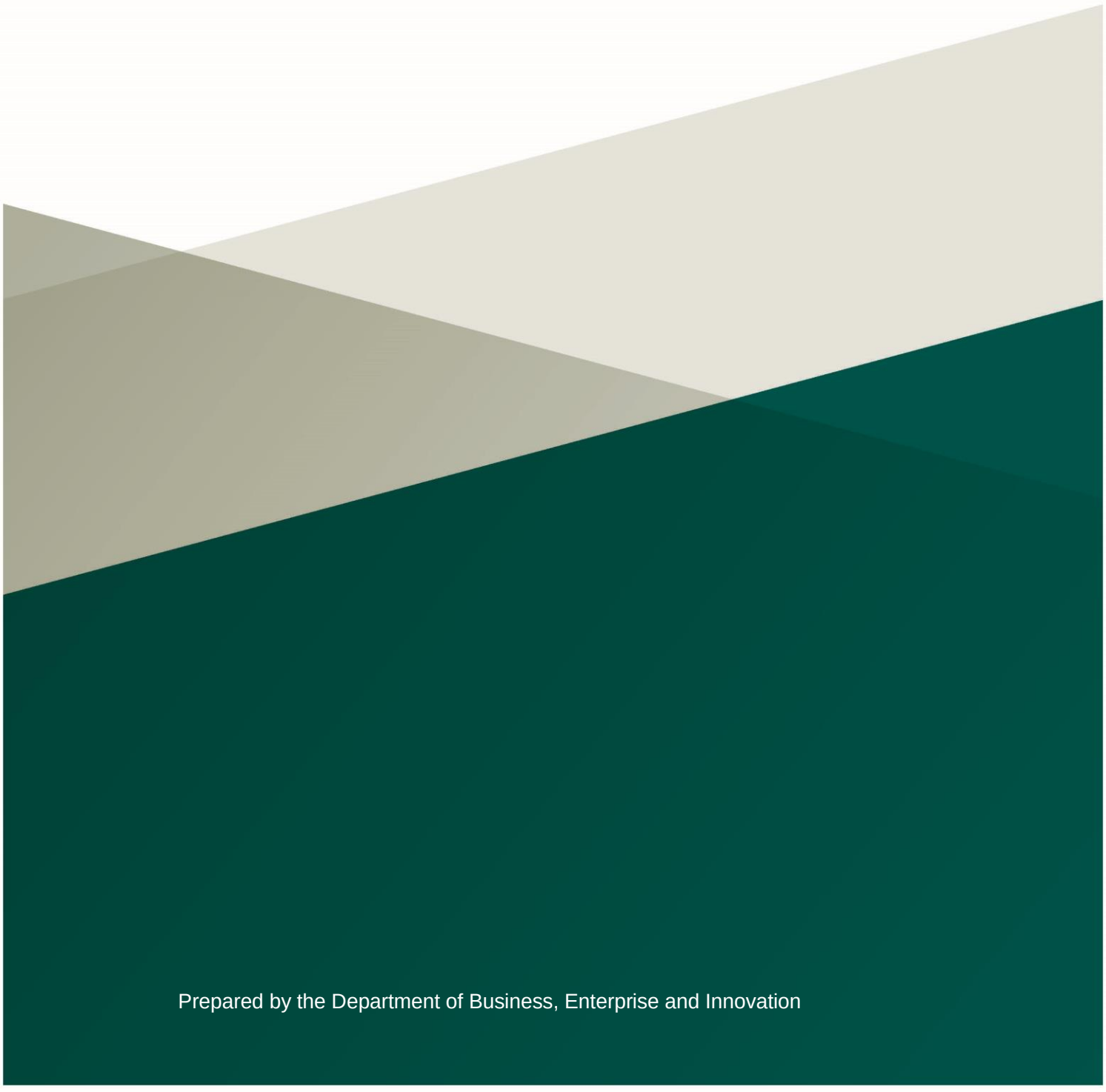
Rialtas na hÉireann
Government of Ireland

Focus on Technology

December 2018



Prepared by the Department of Business, Enterprise and Innovation

Technology

Ireland – a competitive global technology hub – attractive for mobile strategic investment and technology-rich start-ups

GLOBAL MARKET

GLOBAL SOFTWARE **$335.2bn** (2017)

GLOBAL IT HARDWARE **$53.8bn** (2017)

$4.3 trillion PLATFORMS (2016)

GLOBAL SEMI CONDUCTORS **$387.6bn** (2017)

GLOBAL IT SERVICES **$585.3bn** (2017)

Source: Global Software: Marketline, June 2017; Global IT Hardware: Marketline, December 2018; Global Semiconductors: Marketline, March 2017; Global IT Services: Marketline, March 2017; Platforms: 'The Rise of the Platform Enterprise: A Global Survey, The Center for Global Entrepreneurship.'

IRISH EXPORTS

€112.2bn

in 2016 from agency supported firms

Source: Department of Business, Enterprise and Innovation, Annual Business Survey of Economic Impact, 2016

9 of the top 10 global software companies have a presence in Ireland

9 of the top 10 technology companies have a presence in Ireland

10 of the top 10 born of the internet companies have a presence in Ireland

Source: IDA Ireland

EMPLOYMENT

126,330

in 2017 in agency supported firms

Source: Department of Business, Enterprise and Innovation, Annual Employment Survey, 2017

Direct economy expenditure (DEE)

€10.6bn

in 2016

Source: Department of Business, Enterprise and Innovation, Annual Business Survey of Economic Impact, 2016; DEE relates to total payroll costs, and materials and services sourced from Irish suppliers

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The sector in numbers

	Market Size	Growth Forecast
Global	$335.2bn (Global Software)[i] $53.8bn (Global IT hardware)[ii] $387.6bn (Global Semiconductors)[iii] $585.3bn (Global IT Services)[iv] Platforms $4.3trn (2016)[v]	Global software forecast $384.2bn 2021, 14.6% growth since 2016 Global IT hardware forecast $58.6bn 2022, 9.1% growth since 2017 Global semiconductors forecast $495.2bn 2021, 27.7% growth since 2016 Global IT Services forecast $671bn 2021, 14.6% growth since 2016

Ireland	**Exports (2016)[vi]**	**% of National Exports[vii]**	**5-year CAGR (2011-2016)**	**Employment (2017)[viii]**	**% of National (2017)[ix]**	**5-year CAGR (2012-2017)**	**DEE[x]**
Agency	€112.2bn	57.5%	12.9%	126,330	5.66%	6.71%	€10.8bn
Irish	€2.9bn	1.5%	13.5%	31854	1.43%	6.65%	€2.1bn
Foreign	€109.3bn	56%	12.9%	94,476	4.23%	6.73%	€8.8bn

i) Global Software Marketline, June 2017
ii) Global IT Hardware, Marketline, December 2018
iii) Global Semiconductors, Marketline, March 2017
iv) Global IT Services, Marketline, March 2017
v) Platform Economy: Technology-driven business model innovation from the outside in, Accenture, 2016
vi) ABSEI 2016, DBEI (includes computer, electronic and optical products; electrical equipment; computer programming; computer consultancy activities; computer facilities management activities: other IT and computer service activities, the data includes companies involved in technology platforms)
vii) Percentage of national exports is derived using total exports from ABSEI 2016
viii) AES 2017, DBEI (includes computer, electronic and optical products; electrical equipment; computer programming; computer consultancy activities; computer facilities management activities: other IT and computer service activities, the data includes companies involved in technology platforms)
ix) Percentage of national employment is derived using CSO total employment, LFS time series data, seasonally adjusted, Q4 2016.
x) Direct Economy Expenditure relates to total payroll costs, and materials and services sourced from Irish suppliers

Description of the sector globally

- Technology developments impact upon all business, sectors and society, bringing radical changes in production processes, services, consumer interfaces and value chains, as well as driving the development of new markets.
- Digital transformation and disruptive technologies are transforming the nature and profile of the technology sector itself, blurring lines of market segmentation, enabling the creation of digital market places, social media platforms, crowd sourcing platforms and re-defining competitive rules.
- The technology sector is segmented as:
  - Software products and services, including development of on-premises and internet/cloud based applications, mobile apps, networks and analytics tools.

- Electronics, hardware and firmware, including semiconductors, integrated circuits, networking, computing, storage and end-user devices and appliances.
- Digital Platforms, technology-enabled business models that create value by facilitating exchanges and sharing business services between two or more interdependent groups comprising of companies, people, data, processes and things enabling the digital ecosystem. Digital platforms serve to create digital market places, social media platforms and activities involved in the collaborative (sharing) economy.
- IT Services including: technology installation, integration, testing and monitoring services; specialised consulting (such as Security and User Experience Design) and; software/hardware design and development services and data processing and business process outsourcing.

Global developments and implications

- New technologies are revolutionising how day-to-day lives are managed, how products and services are developed and delivered, and how we interact with each other. New markets are evolving more quickly than ever before. Markets that did not exist ten years ago are now multi-billion-dollar markets.
- Developments in computing and storage, data capture, analytics and visualisation, digital platforms, networks and communications and Internet of things (IoT) are disrupting the technology sector segmentation and business models.
- Artificial Intelligence (AI) is pervading all sectors. AI is enabled by a range of subdisciplines from speech and image recognition to deep learning capability. Currently AI applications are confined to 'narrow AI'. Narrow AI enables a high-functioning system that replicates - and perhaps surpasses - human intelligence for one dedicated purpose such as Big Data analytics and personal assistant technologies like Siri. Deep machine learning presents potential for 'Strong' or 'General' AI which involves a machine with consciousness and ability to apply intelligence to any problem, rather than just one specific problem.
- The technology services industry is evolving from offering services that improve productivity to providing value-added services such as analytics consulting; this increases rivalry as players seek to capture a share in higher margin sectors.
- Digital Platforms, providing search and social media (Google, Facebook), marketplaces; AWS (Amazon Web Services) and other crowd sourcing platforms (e.g. Airbnb and Uber) are having a transformative impact on their respective sectors. However, the pace of 'uberisation' is perhaps less than previously anticipated.
- Cybersecurity and Regulation have potential impact on growth. Connectivity and interoperability between existing and new technologies is an on-going issue. Over time, as preferred technologies and standards are agreed, the market opens up for more widespread use of a given technology. Unfortunately, considerable time can be lost while original equipment manufacturers (OEMs) compete. An example is IoT and in Manufacturing 4.0, where the lack of agreed standards is currently restricting market growth.
- At the company level, there is increasing pressure to improve time to market and ensure offerings are best in class in this age of digital disruption. Competition is boosted by a regular supply of new entrants with alternative business models forcing players to operate increasingly competitive pricing strategies.
- There are high levels of mergers and acquisitions, driven by market leaders who are looking to expand activities and to gain access to strategic geographical markets. Many technology companies, through their venture arms, are investing in start-ups within growth areas, particularly in AI. To compete more effectively, would-be competitors are using "coopetition" - pooling their resources for mutual gain in areas where they don't compete directly.

- There is intense global competition for technical skills including emerging skills (incl. data analytics, artificial intelligence and cybersecurity) and increasing demand for soft skills, such as teamwork and problem-solving capabilities.
- Allocation of the taxation rights on profits generated by the sale of digital products is a topic of intense international debate. Effective engagement with the OECD and EU Commission will be required to ensure an equitable distribution of taxing rights between the location where value is created and the location of the sales transaction, so that the potential impact on Ireland's attractiveness to technology companies is minimised.

The sector in Ireland

- Ireland has become a competitive global technology hub, attracting the strategic business activities of technology companies. 9 of the top 10 global software companies, 9 of the top 10 technology companies,10 of the top 10 born of the internet companies and 4 of the top 5 IT services companies have a presence in Ireland.
- Companies at the vanguard of the internet and social media revolution, including Dropbox, Equinix, Google, Facebook, LinkedIn, Amazon, PayPal, eBay and Twitter have joined the sector's traditional players with long-established operations – such as Intel, HP, IBM, Microsoft and Apple in establishing a presence in Ireland.
- Data and its storage and management present a significant opportunity for Ireland. Ireland is at the forefront of the data industry and is in a unique position to benefit further from the exponential data growth and corresponding storage and investment requirements that are forecast to continue over the next decade. Data centres are a key facilitating factor in the industry and as well as providing significant direct economic and employment benefits, they also act as an enabler to unlocking far greater benefits across the €71 billion global technology services export industry and wider digital ecosystem.[1]
- Ireland has a strong entrepreneurial culture and boasts a range of innovative technology-rich high-potential start-ups as well as a number of Irish owned companies focused on niche markets.
- DBEI's firm level report into the impact of Brexit on the most exposed sectors of the Irish economy surveyed firms in the following subsectors: Computer, Electronic and Optical Products; Computer Facilities Management/ Computer Consulting Services and; Computer Programming. The report found the impacts of greatest concern to firms in each of the respective sectors were: imposition of trade tariffs; removal or change in reciprocal work, living, social, and tax entitlements between Ireland and the UK and; restrictions on providing or receiving a service in/from the UK.[2]

Ecosystem

- Technology skills development is a key policy focus in the National Skills Strategy[3] and ICT Skills Action Plans. The EGFSN has recently published a report assessing the impact of digitalisation on Ireland's workforce.[4]

1 https://www.idaireland.com/newsroom/publications/ida-ireland-economic-benefits-of-data-centre-inves

2 An Assessment of the Firm-Level Impact of Brexit on Most Exposed Sectors, DBEI, June 2018

3 https://www.education.ie/en/Publications/Policy-Reports/pub_national_skills_strategy_2025.pdf

4 http://egfsn.ie/Publications/2018/EGFSN-Digital-Transformation-Report.pdf

- Both the mainstream Higher Education Sector and targeted skills programmes offer significant provision in ICT and Computer Science. Ireland now offers an industry-driven post graduate MSc in Artificial intelligence. In addition, courses provided through Springboard+, which provides free or 90% funded upskilling and reskilling higher education opportunities in areas of identified skills need, include areas such as robotics and artificial intelligence, as well as other ICT disciplines such as Cybersecurity, Internet of Things and Cloud Computing.
- ICT is a key research priority and increasingly underpins many of Ireland's other research priority areas. ICT Research priorities include:
    - Future Networks, Communications and Internet of Things
    - Data Analytics, Management, Security & Privacy, and Artificial Intelligence (including Machine Learning)
    - Digital Platforms, Content & Applications, Augmented Reality and Virtual Reality
- There is strong capacity nationally in technology RD&I and industry academic collaboration through Technology and Research centres including: Tyndall (Photonics, Microsystems, Micro/Nanoelectronics and Theory, Modelling and Design), Insight (Data Analytics); ICHEC (High Performance Computing); ADAPT (Global Centre of Excellence for Digital Content); CRANN, (Centre for Research on Adaptive Nanostructures and Nanodevices); CONNECT (Future Networks and Communications), IPIC,(Irish Photonic Integration Centre); CeADAR (Data Analytics Technology Centre), LERO (Irish Software Research Centre); IVI, (IT Innovation Technology Centre), MCCI (microelectronics Technology Centre), and manufacturing Centres I-Form, Confirm and IMR (Irish Manufacturing Research), TSSG (Telecommunications Software and Systems Group); Wireless Access Research Centre in UL; Centre for Unified Computing in UCC; and AMBER Advanced Materials and Bio-engineering Research
- Ireland offers testbed environments to trial new technologies and business solutions. Examples include Test and Trial Ireland offered by Com Reg and Pervasive Nation is Ireland's Internet of Things testbed operated by CONNECT in TCD.
- Dublin City is progressing the development of the Docklands as a leading international 'smart district' for the testing and showcase of new 'smart city' technologies and communications networks. The project was launched in June 2016, hosted by Dublin City Council. http://urbact.eu/smartimpact
- Department of Taoiseach brings together core Government Departments to implement a strengthened approach to continued development of data centres in Ireland focused on the strategic importance of data centres to enterprise development, the Renewable Electricity Policy Development Framework, planning and development, judicial review of major infrastructures.
- There are increasing numbers of co-working spaces aiming to accelerate innovation and entrepreneurial start-up activity. Examples include: wework, Dogpatch Labs in Dublin's Digital Docklands and the Guinness Enterprise Centre.
- Apprenticeships available from 2018 include Network Engineering, Software Development and Manufacturing Data Integration Engineering. From 2019 there will be apprenticeships in Cybersecurity, CGI Technical Artist and Software System Design.

- Current traineeships include IT Support Specialist, Software Developer, IT Network Security and from 2018 an apprenticeship in Automated Software Testing will be available

Relevant Reports

Click on the hyperlinks below

- Digital Transformation: Assessing the Impact of Digitalisation on Ireland's Workforce, EGFSN, December 2018
- A Study of the Economic Benefits of Data Centre Investment in Ireland, IDA Ireland May 2018
- Government Statement on the Role of Data Centres in Ireland's Enterprise Policy, Government of Ireland, June 2018 ICT Skills Action Plan – Government, Education and Industry working together to make Ireland a global leader in ICT talent 2014 -2018, Higher Education Authority (2014)
- Doing more with Digital, National Digital Strategy for Ireland, Department of Communications, Climate Action and Environment (2013)
- Can Ireland take a bigger byte? IBEC (2016)
- Digital Marketplaces for a Platform World, July 2018, Gartner
- Five Ways to Win with Digital Platforms, Accenture (2016)
- Addressing Future Demand for High-Level ICT Skills (Forfás/EGFSN, November 2013)
- Ireland's National Skills Strategy 2025

Key actors

Government: Department of Business, Enterprise & Innovation (DBEI), Department of Education and Skills (DES), Dept. of Taoiseach

Agency: Enterprise Ireland, Science Foundation Ireland, IDA Ireland, HEA, Solas, FETAC, HETAC

Industry: Technology Ireland, Digital Hub, ICT Ireland, Irish Software Association, Irish Software Innovation Network

Recent Developments

Company Developments

- SkOUT Secure Intelligence, provider of cybersecurity technology and solutions is creating 30 high-value jobs with the opening of its new EMEA HQ in Portlaoise, Co Laois (July 2018)
- Neueda Technologies, an IT Training, development and consulting services company headquartered in Belfast, is establishing a Software Engineering Hub in Athlone, Co. Westmeath, employing 200 staff over four years (July 2018)
- Global cybersecurity leader Forcepoint opened a new Centre of Excellence in Cork and will hire 100 new staff in first year of operations (June 2018)
- Trūata, leader in GDPR-compliant data analytics, plans to hire up to 75 personnel – mainly data analysts, data scientists and engineers – for its Dublin headquarters in 2018 (June 2018)
- Amazon opens new office in Dublin and creates 1,000 new technology jobs in Ireland, based in Amazon locations in North County Dublin, Blanchardstown, and Tallaght. Creating 1,000 new jobs doubles the

growth target committed to by Amazon in 2016, when the company pledged to hire 500 people in two years – and did so nine months ahead of schedule (June 2018)

- STATS, the worldwide leader in sports data and intelligence, opened its new offices in Limerick and will employ 100 full and part-time employees by end of 2018 (June 2018)
- Google has announced a €150mn expansion with a new facility at its data centre at Grange Castle in bringing the company's total investment in the Republic since 2003 to €1bn (May 2018)
- Aptiv, provider of software and system solutions for the mobility space, announced today the relocation of its global headquarters to Dublin from the UK. Ireland's favourable regulatory environment, Dublin's continued growth as a vibrant technology hub, and access to top universities were important factors in Aptiv's final selection (May 2018)
- New Relic Inc, provider of real-time insights for software-driven businesses, announced the opening of its new European Headquarters in Dublin. There is space to grow up to 300 team members as well as provide state of the art facilities for hosting customers, meetups, and connecting with the local community (April 2018)
- Rubrik, the Cloud Data Management Company, announced plans to add 50 new jobs in Cork for customer support, IT and sales positions, as part of its continued investment in Europe (April 2018)
- Global software company, LiveTiles, will establish an Intelligent Innovation Centre in Sligo to support the further development of its design and artificial intelligence (AI) products (April 2018)
- Pilz, a global automation technology company opened a new €7.4mn state-of-the-art software development centre in Cork, coinciding with the 20th anniversary of the company's presence in Ireland (March 2018)
- Ammeon, a leading Irish IT Professional Services and Consulting company, is to create 100 new high-skilled jobs over the next
- DecaWave, an indigenous Irish fabless semi-conductor company specialising in precise location and connectivity applications, announced $30mn funding and 100 jobs (February 2018)
- Cloud and Managed Services provider, Ergo, announced that it will be expanding its workforce by 100 people in Dublin and Cork, as it forecasts revenues to hit €100mn by 2020 (February 2018)
- Official opening of Microsoft's new €134m campus, One Microsoft Place, in Dublin (February 2018)
- Autodesk announced the opening of new Dublin office initially hiring 200 people in finance, operations, localisation and sales operations by the end of this year to support its EMEA business (February 2018)
- Technology platform Stripe has announced plans to expand its Dublin office, adding dozens of engineering positions over the next few years (February 2018)

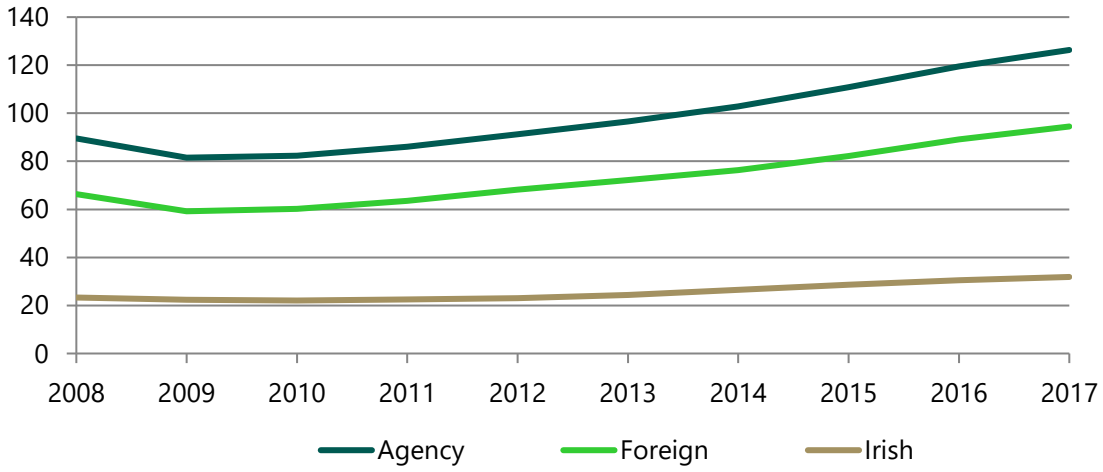
Sector Developments

- Minister Breen signed an EU Declaration on Artificial Intelligence aimed at harnessing opportunities for Ireland in the sector (April 2018)
- Enterprise Ireland launched a new €750,000 Competitive Start Fund for Fintech and Deep Tech start-up companies that have the capacity to succeed in global markets. The fund is designed to enable recipient companies working in areas including fintech, proptech, artificial intelligence, machine learning, augmented and virtual reality, the internet of things, blockchain and cloud, to reach key technical and commercial milestones. (June 2018)

- Skillnet and IDA Ireland launched an innovative Masters programme in Artificial Intelligence (AI). This leading-edge course will help future-proof the IT sector and establish Ireland as a centre of excellence in AI. The programme, will run in University of Limerick from September 2018
- Tech/Life Ireland (www.techlifeireland.com) is a government-funded marketing initiative to brand Ireland as a top destination to pursue a career in technology. The initiative is being delivered in partnership with Enterprise Ireland, IDA Ireland and the tech industry and uses digital and social media to showcase the lifestyle, tech environment and job opportunities available in Ireland.
- NDRC@ArcLabs Start-Up Accelerator in Waterford is open to applications from potential teams or individuals both in Ireland or overseas in all technology sectors (December 2017)

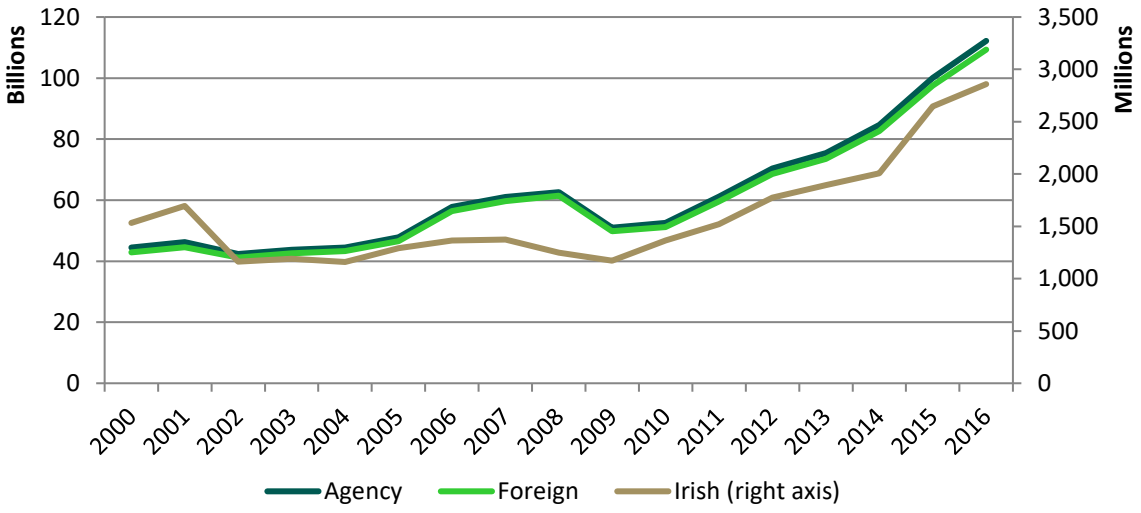
Data Trends

Employment in Agency-Assisted Companies in the IT Software Systems and Services (2007-2017)



Foreign firm employment decreased between 2006 and 2009 however has been steadily increasing since then. Irish firm employment has remained steady over the years, experiencing a slight increase in the last two years.

Exports of Agency-Assisted Companies in the IT Software Systems and Services (2000-2016)



Agency exports were experiencing a period of growth up until 2009. However, they soon recovered following the economic downturn and have been rapidly increasing since 2010.

Sources: Annual Employment Survey (employment), ABSEI (exports) – various years