PHOTONICS **IRELAND**

MAKING LIGHT WORK

IRELAND'S NATIONAL TECHNOLOGY PLATFORM

PHOTONICS IRELAND
NATIONAL TECHNOLOGY PLATFORM

PHOTONICS IRELAND WILL FOCUS ON ACTIVITIES ACROSS **TECHNOLOGY**, **INCUBATION** AND **TRAINING** TO DRIVE GROWTH IN HIGH IMPACT SECTORS IN IRELAND

1 INTRODUCTION

Photonics is the generation, manipulation and utilisation of light. It is a key enabling technology that underpins the internet and over the next decade will make a significant impact to our everyday lives – transforming industries and improving societies across the globe.

Ireland has been active in the field of photonics for many years – from the development of leading edge technology to its deployment in global markets such as ICT and Life Sciences. Now, in order to build on our current standing, the Irish photonics community must work together to significantly strengthen and maximise Ireland's position as a world leader in one of the globe's fastest growing sectors.

Photonics Ireland, Ireland's National Technology Platform (NTP) for Photonics, brings together Ireland's photonics companies, technology users and stakeholders, to define a common strategy and identify and execute activities which will increase economic activity, drive job creation and develop technologies which will significantly improve our day to day lives.

At a European level, Photonics NTPs come together under Photonics21, an umbrella organisation for the European photonics community with over 2,500 members. It has a Public Private Partnership (PPP) with the European Commission that represents a long-term commitment to invest in Europe, with the aim of securing Europe's industrial leadership and economic growth, a highly skilled workforce, and the capability to generate new jobs that attract the brightest of our young people. Through the establishment of a National Technology Platform, we are creating a national vehicle to engage with Photonics21, the European Commission and other international photonics platforms – leveraging existing networks and creating strategic partnerships which will benefit both the Irish and European economies.

€250 BILLION PROJECTED MARKET GROWTH BY 2020

Furthermore, Photonics Ireland will provide a framework to strategically focus national activities in the area of technology development, start-up company incubation and highly skilled graduate training, in order to deliver an enduring and sustainable impact across the economy. It is only through a strategic commitment and coordinated effort that Ireland can capture a share of the projected market growth of €250 billion by 2020 and the expected 30,000 new jobs across Europe in the next 5 years.

This Photonics Ireland framework 'Making Light Work', outlines our vision for the photonics sector in Ireland – detailing measures and actions which will achieve our goals and put Ireland at the forefront of the global photonics market. Initiated and coordinated by the Irish Photonics Integration Centre (IPIC), the Photonics Ireland NTP will be governed and supported by a Steering Committee comprising key stakeholders from across industry, academia and government.

30,000 EXPECTED NEW JOBS ACROSS EUROPE IN THE NEXT 5 YEARS

2 PHOTONICS – A GLOBAL AND EUROPEAN SNAPSHOT

Photonics is everywhere around us: from communications & health, lighting & photovoltaics to everyday products like DVD players & mobile phones. Increasingly, it is becoming more significant in a diverse range of sectors such as:

Agriculture
Scanning technology and infrared imaging to monitor food production and quality, sensor systems for planting and irrigation

Green Energy Source
Photovoltaic devices are used for solar electric panels.

Information Communications Technology
Optics for data storage, transmission across fibre-optic networks and displays

Life Sciences
Testing and analysis devices such as noninvasive glucose monitors

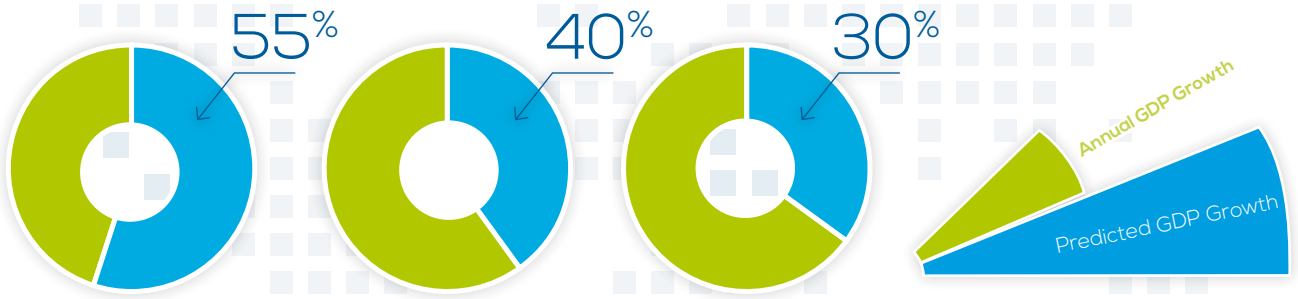
Medical Technology
Lasers for surgery, photodynamic therapy, smart surgical instruments

The global photonics market, which is estimated to be €350 billion, continues to grow and it is projected to reach over €600 billion by 2020. Of this market, Europe has an overall share of almost 20% (€66 billion) and directly employs over 300,000 people, with employment expected to increase by 10% by 2020 through the creation of new high value jobs. In 2014, a global salary survey by SPIE, the international society for optics and photonics, reported that the median salary for 6,000 respondents was $73,000.

In 2013 Photonics 21 entered into a Public Private Partnership (PPP) with the EU Commission to invest in photonics research through the H2020 programme with the aim of securing Europe's industrial leadership and economic growth. Furthermore, with high profile announcements such as President Barack Obama's $200 million endorsement of an integrated photonics manufacturing institute in the US, photonics is being championed at the highest level.

$73,000 THE MEDIAN SALARY FOR 6,000 RESPONDENTS

Photonics Manufacturing in Europe



Europes photonics industry holds about 55% of the world market in production technology, including laser material processing and lithography equipment

Europe's market share in optical components and systems is 40%

Europe's share in Medical Technology & Life sciences (a key industry for Ireland) is 30%

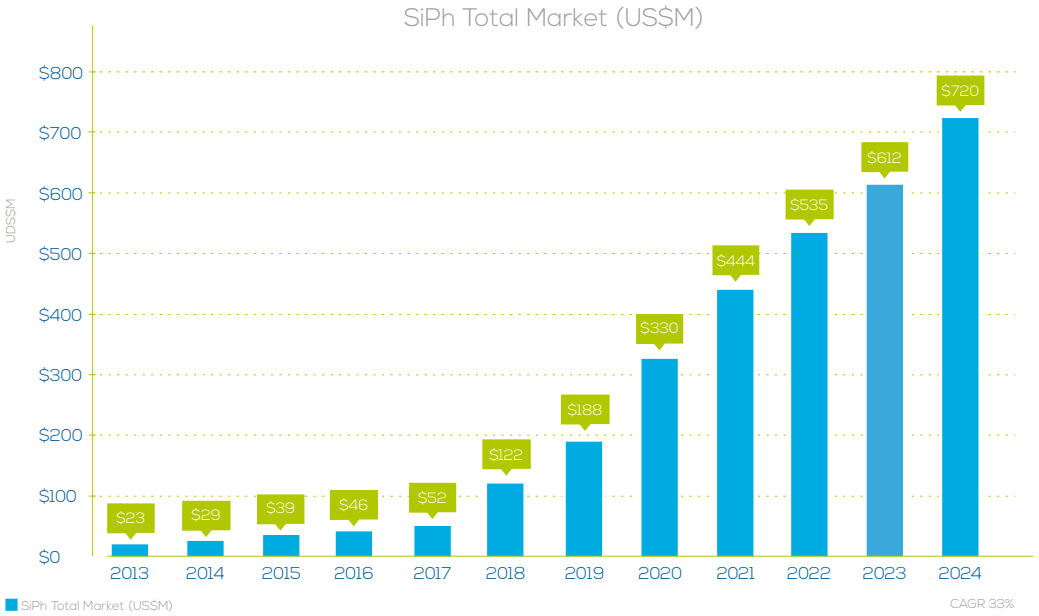
The long-term outlook for 2020 predicts that photonics will experience continuing nominal growth of 6.5% out-growing the global average annual GDP growth by about 50%, and resulting in a Photonics market volume of 615bn Euro by 2020, contributing to wealth and job creation

(Source: Photonics Industry Report 2013)

Major global growth is expected in applications such as medical technologies, life sciences and optical communications – areas where the European and Irish Photonics industry is particularly strong. This will be driven by new advances in photonics technologies and manufacturing processes that improve product performance while simultaneously reducing unit cost, energy usage, and environmental impact. Additionally, the rapidly emerging market of silicon photonics is projected to expand from less than $50M in 2015 to over $500M by 2022.

Silicon photonics

is the use of silicon as the optical medium, the material that guides the light in photonic systems. It utilises semiconductor manufacturing techniques to create patterns and structures on a sub-micrometre scale, greatly reducing device size and increasing efficiency, while also enabling the fabrication of integrated electronic and photonic circuits on one single microchip. Such chips have many potential applications, such as increasing the data transfer between microchips and data storage drives, enabling the ICT sector to continue the progression of Moore's Law



3 SPOTLIGHT ON IRELAND

The Irish photonics industry has been developing rapidly over the last number of years. Currently, there are over 25 Irish SMEs and start-ups who develop and use photonics technologies – all providing high skilled jobs throughout the country. Interestingly, many of these companies have spun out from the academic sector – highlighting the significance of photonics research for the development of the industry.

Through a number of Research Performing Organisations (RPOs), such as universities and institutes of technology, and national research centres, such as IPIC, the Irish Photonics Integration Centre ; CONNECT, the Centre for Future Networks & Communications and CAPPA, the Centre for Advanced Photonics & Process Analysis, Ireland has an established world class photonics research infrastructure. This includes research in areas such as bio photonics, photonics integration & packaging, optical networks, photonic devices etc, and aligns with 5 of Ireland's research priority areas; namely Future Networks & Communications, Connected Health and Independent Living, Medical Devices, Diagnostics and Manufacturing Competitiveness.

Equally, Ireland's large multinational community – in particular in the medical device and ICT sectors including communications companies, are continuously increasing their reliance on photonics technology and increasing their activities in this space in order to exploit the ever growing opportunities for photonics integration in their next generation products.

Ireland Winning in Europe

Irish Medical Diagnostics Company Radisens secures significant EU investment

Radisens Diagnostics, an Irish medical diagnostics company developing a near-patient device using photonics technology to instantly test for high-burden chronic disease anywhere, was awarded a €4.5m grant from the European Commission's SME Instrument initiative. As part of the EC's Horizon 2020 Research and Innovation programme, the €3bn SME Instrument hand-picks potentially disruptive businesses to invest and support.

Near-patient blood testing is one of the fastest growing segments of the healthcare industry, fuelled by the push towards improving patient outcomes, healthcare efficiencies and quality standards. It closes the linkage between diagnostics and therapeutics, as current lab tests require days before results are available. Radisens' vision is that of a confirmed diagnosis, clinical counselling and prescribed therapies all within a single physician or pharmacy visit, without fear of needles or anxious days of waiting for results, thereby empowering patients to better manage their chronic disease.

IRISH MEDTECH SECTOR

The medical technology sector in Ireland is recognised as one of the five global emerging hubs. The sector employs over 25,000 people in Ireland which represents 6% of Europe's medtech workforce. Ireland is one of the largest exporters of medical products in Europe with annual exports of €8bn and companies here directly export to over 100 countries worldwide. 18 of the world's top 25 medical technology companies have a base in Ireland and 50% of the 300 medtech companies based here are indigenous.

- Biosensia
- ClearSight Innovations
- Compact Imaging
- Eblana Photonics
- Epi-Light
- Equilume
- Lake Region Medical
- Luxcel Biosciences
- Radisens Diagnostics
- SensL
- Stryker
- Teleflex Medical
- VistaMed

ICT SECTOR

Ireland is emerging as a global technology hub. The sector is thriving, with exports and employment in both indigenous and multinational technology firms continuing to grow. In the last three years over 17,500 jobs have been announced by technology companies and the sector is responsible for 40% of our national exports (€72 billion per annum). The technology sector in Ireland directly employs over 105,000 people, with 75% employed in multinational companies and the remainder in the indigenous digital technology sector.

- Alcatel-Lucent
- Aurora Telecom
- BT
- Eircom
- FAZ Technology
- Firecomms
- Huawei
- Intel
- MACOM
- Pilot Photonics
- Tokyo Electron
- X-Celeprint
- Xilinx
- Seagate
- Xylophone Optics

INDUSTRIAL TECHNOLOGY

Industrial technology is the use of cutting edge engineering and manufacturing technology to make production faster, simpler and more efficient. The industrial technology field underpins many sectors of the economy - driving growth by helping companies achieve efficient and profitable productivity.

- Dyoptyka
- Enterasense
- Feasa Enterprises
- Hach
- InfiniLED
- LED Group
- NewLambda
- Ocean Optics
- Pie Photonics
- ProPhotonix
- Somex
- Superlum

IRELAND'S RESEARCH LANDSCAPE

RPOs

NUI Galway
OÉ Gaillimh

UCD
DUBLIN

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

University of Limerick
Ollscoil Luimnigh

Tyndall
National Institute
Institiúid Náisiúnta

Maynooth University
National University of Ireland Maynooth

DCU

Waterford Institute of Technology

Dublin Institute of Technology
D·I·T
Institiúid Teicneolaíochta Átha Cliath

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

CIT
Cork Institute of Technology
Institiúid Teicneolaíochta Chorcaí

RESEARCH CENTRES

CONNECT
Networks of the Future

CONNECT is a flagship SFI research centre for communications networking, services, applications and technologies

IPIC
BRINGING PHOTONICS TO LIFE

IPIC is an SFI research centre developing photonic integration technologies for the ICT and medtech sectors

CIT CAPPA
CENTRE FOR ADVANCED PHOTONICS AND PROCESS ANALYSIS

CAPPA is an Enterprise Ireland technology centre conducting both applied and fundamental research in photonics

LEADING PRINCIPAL INVESTIGATORS (PIs)

BIO PHOTONICS
Hugh Byrne (DIT)
Tia Keyes (DCU)
Martin Leahy (NUIG)
Colette McDonagh (DCU)
Malini Olivo (NUIG)
Dmitri Papkovsky (UCC)

PHOTONIC DEVICES
Brian Corbett (Tyndall)
John Donegan (TCD)
Stephen Hegarty (CIT-Tyndall)
Guillaume Huyet (CIT-Tyndall)
Pascal Landais (DCU)
John McInerney (UCC-Tyndall)

OPTICAL COMMUNICATIONS & SENSORS
Liam Barry (DCU)
Michael Connelly (UL)
Gerald Farrell (DIT)
Elfed Lewis (UL)
Paul Townsend (Tyndall)

NANOPHOTONICS & PLASMONICS
Louise Bradley (TCD)
Enda McGlynn (DCU)
James Rice (UCD)
Dominic Zerulla (UCD)

IMAGING
Nicholas Devaney (NUIG)
Eithne McCabe (TCD)
Thomas Naughton (NUIM)
John Sheridan (UCD)
Brian Vohnsen (UCD)

PHOTONIC MATERIALS
Werner Blau (TCD)
Paul Eastham (TCD)
Eoin O'Reilly (UCC-Tyndall)
Peter Parbrook (UCC-Tyndall)
Martyn Pemble (UCC-Tyndall)

LASER-MATERIAL INTERACTIONS & MANUFACTURING
John Costello (DCU)
Padraig Dunne (UCD)
James Lunney (TCD)
Gerard O'Connor (NUIG)
Gerry O'Sullivan (UCD)

QUANTUM OPTICS & TECHNOLOGIES
Emanuele Pelucchi (Tyndall)
Andreas Ruschhaupt (UCC)

PHOTONIC INTEGRATION & PACKAGING
Peter O'Brien (Tyndall)
Frank Peters (UCC-Tyndall)

> **The research work that Tyndall is carrying out for Eblana in the area of photonics is vital to the creation of our next generation products**
>
> Jim Somers, CEO, Eblana

> **Working with a world-class Irish Research Centre such as IPIC has ensured that Intel remains at the forefront of photonics development**
>
> Bernard Capraro, Research Manager, Silicon Technology, Intel Ireland

> **For InfiniLED, the Photonics National Technology Platform is putting a stronger and a more coordinated structure around photonics – giving us access to equipment and infrastructure, broader expertise and qualified staff**
>
> Joe O'Keeffe, CEO, InfinLED

4 A NEW HORIZON FOR PHOTONICS IN IRELAND

OUR VISION

With a thriving global and European photonics industry and an ever growing Irish photonics ecosystem, now is the time to pool our resources, coordinate our efforts and put a coherent strategy in place to leverage this burgeoning market.

Photonics Ireland, Ireland's National Technology Platform aims to achieve this by stimulating and supporting photonics activities in Ireland which will in turn drive economic growth across a number of sectors.

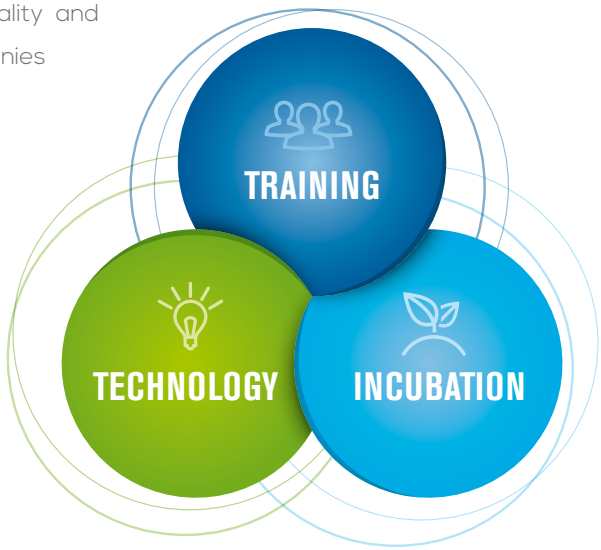
Achieving a critical mass in this joint effort will be critical for identifying and delivering capital efficient, market aligned innovation through strategic partnerships and initiatives between public and private stakeholders throughout Ireland and Europe.

Photonics Ireland has identified three core areas which are critical to the development of the sector in Ireland:

1. Technology Access to leading edge photonics technology for next generation products in order to improve product functionality and performance will be critical in order for companies based in Ireland to compete globally

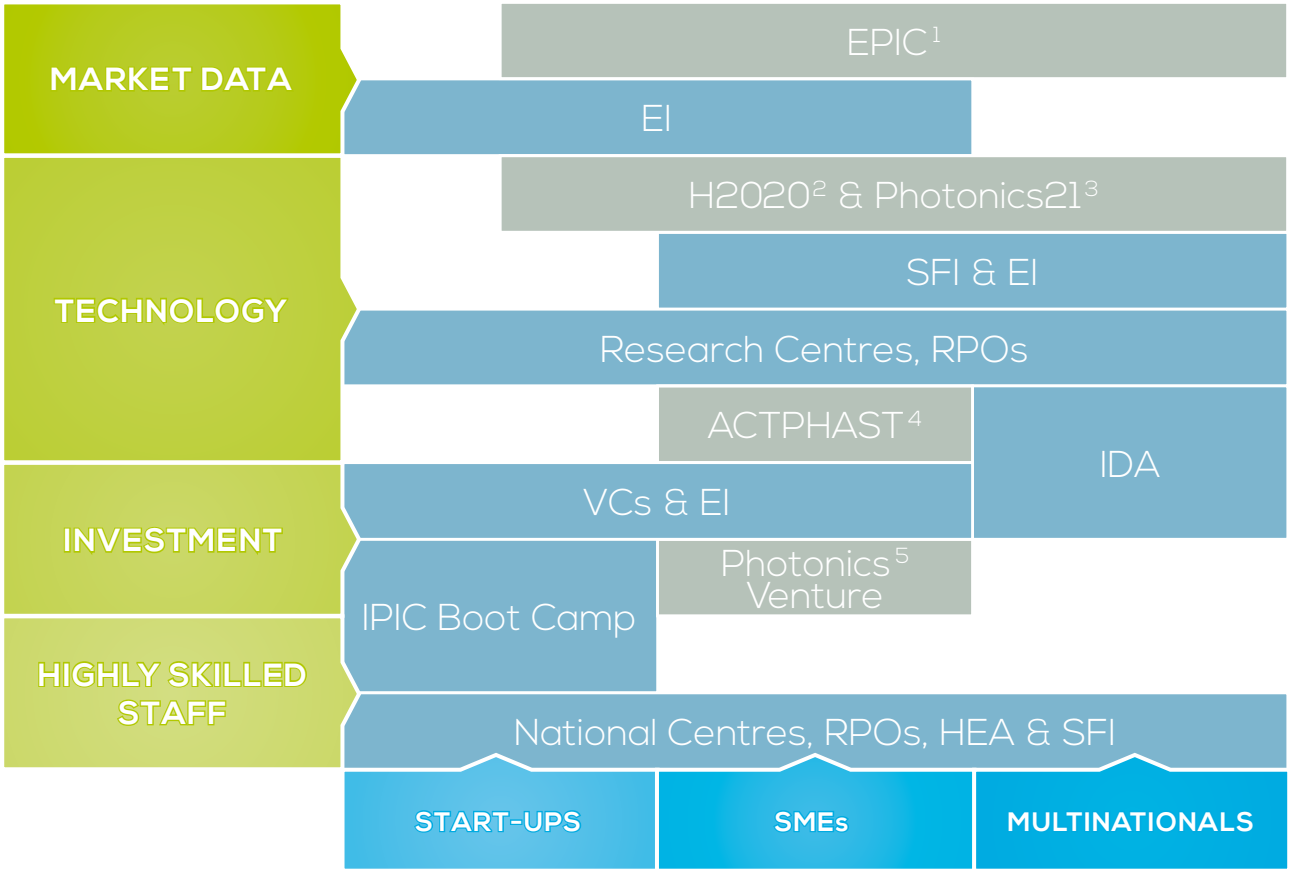
2. Incubation Developing and nurturing start ups from idea to launch and subsequent scaling. Access to mentoring on key aspects of business development, proximity to research teams, facilities, potential investment opportunities etc

3. Training Access to world class talent in photonics and the ongoing development of skills aligned with industry needs



Underpinning these areas are a number of key ingredients which all companies, regardless of scale will require in order to grow and achieve further success. These are: 1. Access to Market Data, 2. Access to Technology, 3. Access to Investment and 4. Access to Highly Skilled Staff.

Through a wide variety of organisations, programmes and initiatives across Ireland and the EU, the photonics sector has access to a substantial number of supports. By aligning start-ups, SMEs and multinationals to the relevant supports across our focus areas of Technology, Incubation and Training, Photonics Ireland will develop a coordinated action plan which address the needs of companies within the Irish photonics community and develop a network of key stakeholders to connect Irish strengths to emerging market opportunities.



EUROPEAN SUPPORTS

EPIC

The European Photonics Industry Consortium (EPIC) is the industry association that promotes the sustainable development of organisations working in the field of photonics in Europe.

H2020

H2020 is the biggest EU research and innovation programme to date with a budget of nearly €80 billion over seven years.

Photonics21

Photonics21 is the umbrella organisation for the European photonics community with over 2500 members.

ACTPHAST

ACTPHAST (Access CenTer for PHotonics innovAtion Solutions and Technology Support) is a unique "one-stop-shop" for supporting photonics innovation in European SMEs.

Photonics Venture

The European Photonics Venture Forum aims to market the photonics sector to a wider investor community and create channels to finance for high-potential photonics businesses.

IRISH SUPPORTS

SFI Science Foundation Ireland

ENTERPRISE IRELAND where innovation means business

IDA Ireland

5 MEASURES FOR SUCCESS

In order for Photonics Ireland to successfully deliver its vision for photonics in Ireland it must ensure that a series of critical actions are undertaken across the areas of Technology, Incubation and Training. The successful implementation of these actions will ensure that Ireland will remain an attractive location to support existing activities and attract new global photonics companies and activities. Throughout the following sections, a series of short, medium and long term actions have been outlined across core focus areas in order to ensure that Ireland can successfully compete in the global photonics market.

Initially, Photonics Ireland will undertake a study to comprehensively map companies in Ireland who are active in photonics. This will allow the National Technology Platform to fully support all companies and build strategic alliances and partnerships on a national level. By utilising business and industry associations, such as those in the technology and medical devices sectors, we can create links, provide information and disseminate the necessary information and data which will drive growth and innovation in this space.

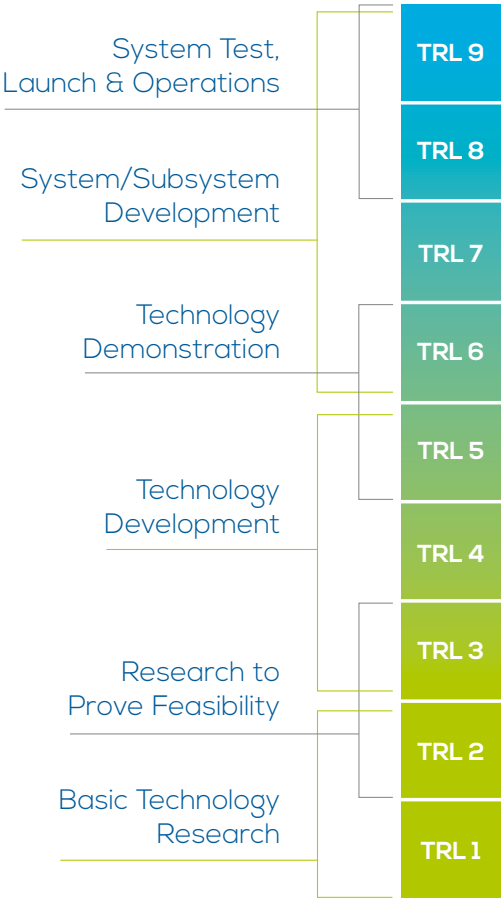
TECHNOLOGY

There has been significant investment in Ireland's photonics research community and infrastructure over the last number of years by Science Foundation Ireland and Enterprise Ireland. Through the creation of National Centres such as IPIC, CONNECT and CAPPA, the Irish Government has endorsed photonics as a key strategic priority for Ireland.

Central to the success of these Centres, is not just the development of novel scientific learnings or early stage prototypes, but the establishment of an ecosystem that can take breakthrough ideas from first principles to design for manufacturing and demonstration, i.e., to Technology Readiness Levels 5 and 6. This will help avoid the so called 'Valley of Death' where emerging technologies fail to be deployed in the market as a result in a gap in the mid TRLs (4-6) between the academic and industry communities.

Having access to this level of technological capabilities is invaluable to industry. The mechanisms for accessing this technology and the associated supports must be strengthened and fostered in order to create a fully integrated ecosystem that benefits both industry and academia.

Additionally, companies can participate in H2020 programmes to secure R&D investment, access to leading edge technology and to build partnerships with potential customers.



Actions:

1. Invest in photonics research

a. Map the national research landscape in order to get a clear picture of the competences, capabilities and activities of photonics researchers in Ireland e.g. capabilities database

b. Through an industry focused survey, identify any gaps in the photonics research landscape in which Ireland needs to address in order to be more competitive

2. Increase collaborative industry engagement

a. Develop an online portal/newsletter to communicate capital efficient mechanisms for companies to access technology through national and EU programmes

b. Increase the number of companies engaging in photonics based collaborative research projects and in H2020 programmes by providing regular updates to industry on partner and funding opportunities

HORIZON2020 THE BIGGEST EU RESEARCH AND INNOVATION INVESTMENT
YET WITH A BUDGET OF NEARLY €80 BILLION OVER SEVEN YEARS

INCUBATION

The start-up and SME sector is vital to any long term growth prospects in the Irish economy. The Irish entrepreneurial spirit, together with the backing of a large base of private investors and the support of state agencies such as Enterprise Ireland, has driven innovation and job creation over the last number of years.

According to the Irish Venture Capital Association, Irish start-ups and SMEs raised around €401 million in 2014, an increase of almost 41% from €285 million raised in 2013. Technology start-ups continue to lead the way and Ireland's reputation as a technology hot-bed continues to grow with around an eighth of funds raised in 2014 coming from Silicon Valley.

Additionally, the establishment of Knowledge Transfer Ireland (KTI) has further strengthened the start-up ecosystem by working with business, investors, universities, institutes of technology, state research organisations, research funders and government agencies to maximise state funded technology, ideas and expertise getting into the hands of business to drive innovation.

Photonics Ireland now wants to build on the growth in the start-up sector and put measures in place in order to encourage new entrepreneurs to access the support they need to turn their ideas into a scalable business, which will in turn create jobs.

RPOs have a proven track record of creating photonics start-ups:

DCU	Pilot Photonics
Trinity	Eblana
Tyndall	Firecomms, InfiniLED, Sensl, Biosensia
UCC	Luxcel
UCD	Equilume, NewLambda Technologies

Actions:

1. Catalyse new ventures

a. Identify and establish supports for High Potential Start-Ups (HPSUs) with objective of successfully launching 2 start-ups per year

b. Launch the IPIC Bootcamp

2. Increase access to investment

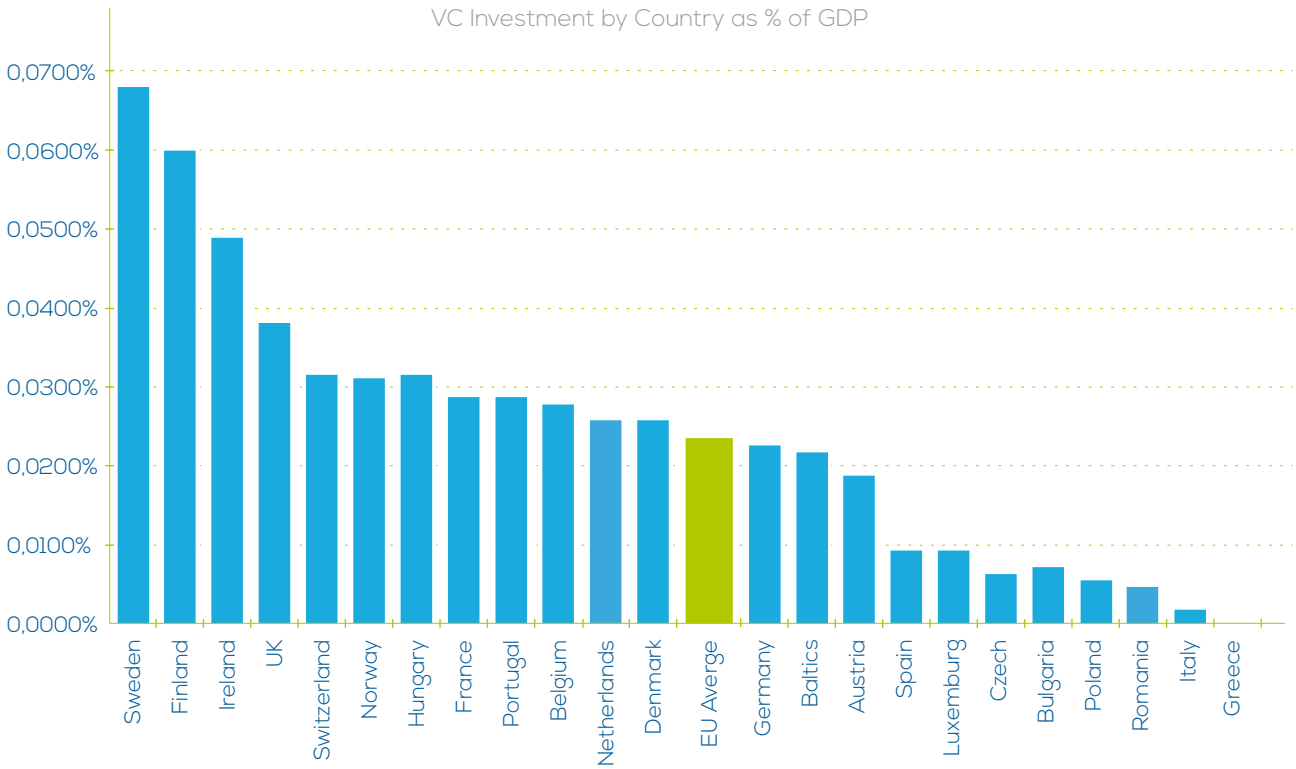
a. Attract and support a Photonics Venture Forum to Ireland to increase access to investment to Irish start-ups and increase Ireland's visibility in photonics start-ups across Europe

b. Engage and develop strong relationship with the Irish VC Community through the IVEC who are recognised as being highly active in the technology start-up space

c. Build relationships with established photonics NTPs and clusters to increase the visibility of the Irish photonics community

IPIC BOOTCAMP a photonics focused start-up accelerator to stimulate start-ups from academia and industry. This programme will be delivered by photonics experienced entrepreneurs in partnership with an established start-up programme supplier (NDRC)

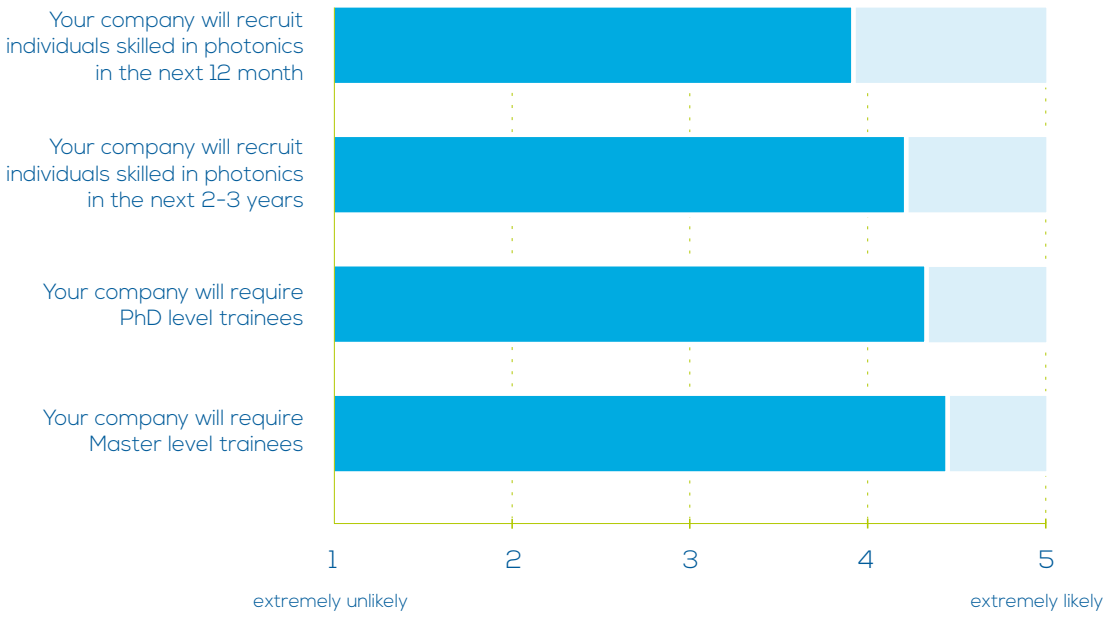
Ireland has an active VC community and is now recognised as a leading location for technology start-up companies



TRAINING

With the projected rapid growth in photonics, a key challenge over the coming years will be the supply of high calibre researchers who can meet the demands of both industry and academia. Ensuring we meet the need for highly qualified personnel is critical for Ireland to elevate its position in the growing photonics related global economy. Indeed, a recent industry survey carried out by IPIC demonstrates the opportunity for those with the right skillset to benefit from the growth in the sector.

A recent Industry survey by IPIC, companies were asked to indicate on a scale of 1 - 5, their **recruitment plans in relation to photonics**, where 1 represents 'extremely unlikely' and 5 represents 'extremely likely'.



Marie Skłodowska-Curie Actions

(MSCA) provide grants for all stages of researchers' careers - be they doctoral candidates or highly experienced researchers - and encourage transnational, intersectoral and interdisciplinary mobility. The MSCA aim to attract and develop the most promising future science leaders

The skills demand for ICT talent is a global one. Already, it is estimated that there is a shortage of up to 864,000 ICT professionals across the EU and the European Economic Area (EEA).

Ireland is likely to face an average increase in demand for high-level ICT skills of around 5% a year out to 2018 with the employment of ICT professionals anticipated to rise to just over 91,000.

Meeting the continuing strong domestic demand for ICT professional skills will require an increase in the numbers of high quality graduates in ICT disciplines. We must therefore build on established HEA and SFI funding programmes to ensure that Ireland is a destination of choice for top tier talent from around the world.

By leveraging supports through Horizon 2020's Marie Skłodowska-Curie actions (MSCA) such as Innovative Training Networks (ITN) and COFUND schemes, we can access the best and brightest that Europe has to offer.

Furthermore, developing training programmes, not just in technical areas, but the development of skills in leadership, marketing/sales, project management as well as specific employer-led training and development will be essential in fostering our growing start-up and SME community.

Finally, as part of a longer term strategy, Photonics Ireland will implement a national outreach programme which will be aimed at second & third level students and graduates in order to promote careers in Science, Technology, Engineering and Maths (STEM). By increasing the number of students undertaking courses in these disciplines, we can increase the number of students available to pursue a career in photonics. Building on activities for the International Year of Light throughout 2015, Photonics Ireland will participate and drive exciting programmes aimed at students and the general public in order to stimulate interest in the area of photonics.

Actions:

1. Increase the photonics skills base in Ireland

a. Train over 100 PhDs in the period 2015 to 2020
b. Identify the skills and training needs of industry and develop programmes to address these e.g. postgraduate courses
c. Secure funding from H2020 MSCA programme in order to put high quality training structures in place to ensure that we can attract the best talent from Europe

2. Raise the profile of photonics in Ireland through targeted communications activities

a. Implement an integrated national outreach plan that complements existing ICT & Photonics outreach programmes in Ireland, such as the National Biophotonics Imaging Platform and the International Year of Light 2015
b. Promote and profile Ireland as a location of excellence in relation to careers in photonics through a targeted communications and recruitment strategy

The National Biophotonics Imaging Platform

provides a structured research and training framework for advanced imaging with over 60 postdocs and 50 PhDs trained by 2015

6 NEXT STEPS

The successful implementation of the measures outlined in this framework document will ensure that Ireland is strategically positioned to take advantage of the global opportunities which will arise over the coming years.

Photonics Ireland will act as a single Irish photonics voice and provide strategic direction to all Irish photonics stakeholders – supporting new business generation and creating an industry driven 'innovation ecosystem' which will benefit all. It will raise the profile of and promote the depth and breadth of photonics excellence in Ireland – driving greater visibility at a national, EU and international level.

Key to this initiative's success will be the timely implementation and execution of the recommendations outlined. Overseeing the implementation and direction of the National Technology Platform is the Photonics Ireland Governing Committee. This committee will comprise representatives from industry, the IDA, Enterprise Ireland, SFI, National Research Centres and Academia.

The Governing Committee will:

1. Oversee the ongoing successful implementation of the Photonics Ireland Action Plan
2. Track progress of economic activity in Ireland relating to photonics
3. Act as a forum to share best practice and develop innovative approaches to grow photonics activities in Ireland

It will also have access to a Scientific Advisory Committee which will include leading photonic academics who will give advice and make recommendations to the Governing Committee on scientific direction, issues affecting photonics research & development in Ireland, as well as stimulating industry-academia collaboration in order to drive the National Technology Platform.

By harnessing the strength of our photonics community through this National Technology Platform, we can significantly maximise Ireland's position as a world leader in one of the globe's fastest growing markets; leading to job creation and the development of ground-breaking technologies that will significantly improve our day to day lives

Minister for Skills, Research and Innovation, Mr. Damien English T.D.

PHOTONICS IRELAND
NATIONAL TECHNOLOGY PLATFORM

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