



Photonics  
Technology  
Access for  
Researchers



# ACTPHAST4R:

Open Access to European Photonics Prototyping Platforms  
for  
Innovation-driven Researchers



# Outline of this presentation

- Why Europe needs this innovation initiative?
- What it could offer you
- How it works and who can apply
- The impact we are aiming for

“PHOTONICS” is the science and technology that innovates with the unique properties of light





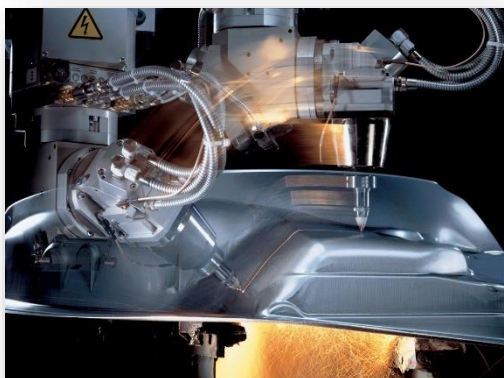
Optical Telecom



Photovoltaics



LED Lighting



Lasers in Manufacturing

# PHOTONICS

a key digital technology



Displays



Machine Vision



Medical Optics



Optical Components



# Photonics a win-win-win-win scenario



Energy friendly



Societal impact



Innovation driver



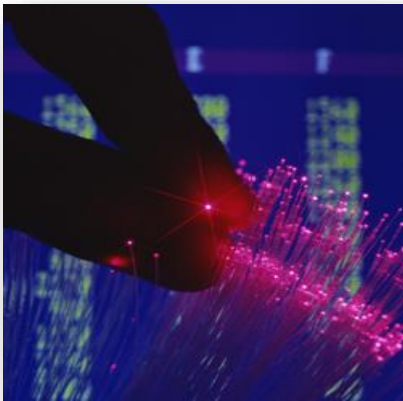
Economic motor

# The impact of photonics on the global and EU economy is huge

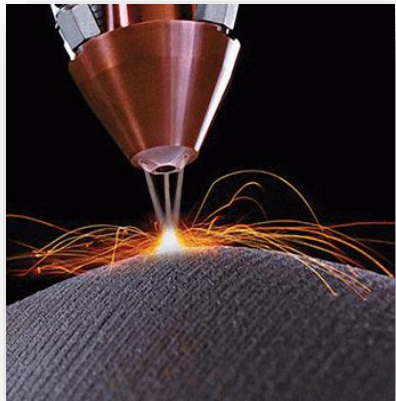
- **Global photonics market € 458 Bn in 2015**
- **EU total share 15% or € 69 Bn**
- **EU Photonics Production CAGR of 5% (> 3,5x EU GDP growth)**
- **Strong export position > 68%**
- **Innovative high tech industry: 9–10% R&D**
- **Leverages at least 10% of the EU economy**
- **More than 5000 SMEs in EU**
- **More than 350000 direct employees in EU**



# Photonics: 1 of 8 key technologies that are presently enabling the processes of discovery and innovation



Photonics



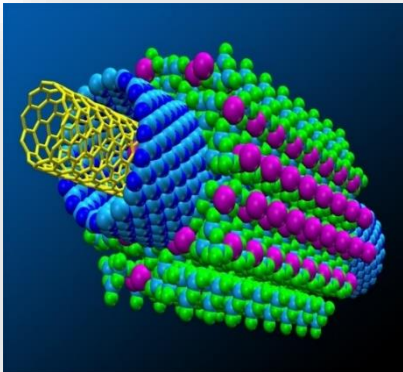
Advanced Manufacturing



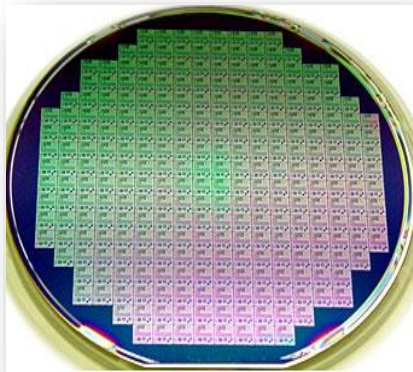
Biotechnology



Advanced Materials



Nanotechnology



Nanoelectronics



Artificial Intelligence



Cyber Security



## Building our digital society

Photonics for a secure and resilient IT infrastructure

### Our mission:

zero downtime in a terabit economy

*"Since light can travel vast distances through fibres, fibre optics consumes only a fraction of the energy used by conventional technology that transports electrons via copper wires."*

## A new quality of urban life

Photonics for smart homes and liveable cities

### Our mission:

10% higher productivity

*"Smart homes and offices will be development hotspots for the Internet of Things (IoT), requiring sensors, cameras, displays and many kinds of optical IT."*





## Empowering Industry 4.0

Photonics in manufacturing and production

**Our mission:**  
a million  
new jobs

*"Manufacturing is already undergoing a photonics revolution, with earlier generations of factory machinery increasingly giving way to lasers and sensors, usually in conjunction with robots."*

## Keep our traffic flowing

Photonics for connected mobility

**Our mission:**  
accident and congestion-free  
road transport

*"Photonics technology holds many of the keys for making vastly safer, more efficient and more comfortable mobility services a reality."*



## Live longer, feel better

Photonics in life sciences and healthcare

**Our mission:**  
instant diagnosis of  
major diseases

*"Already, photonics  
plays a crucial role in  
the diagnosis or  
treatment of virtually  
every major disease."*

## Feed the world

Photonics for safe, nutritious and affordable food

**Our mission:**  
quality food from  
farm to fork

**Field  
Monitoring**

**Soil  
Monitoring**

**Machine  
Operation**

**Water  
Management**

## Zero emission, less waste

Photonics for sustainability and a clean environment

**Our mission:**  
a truly circular  
economy



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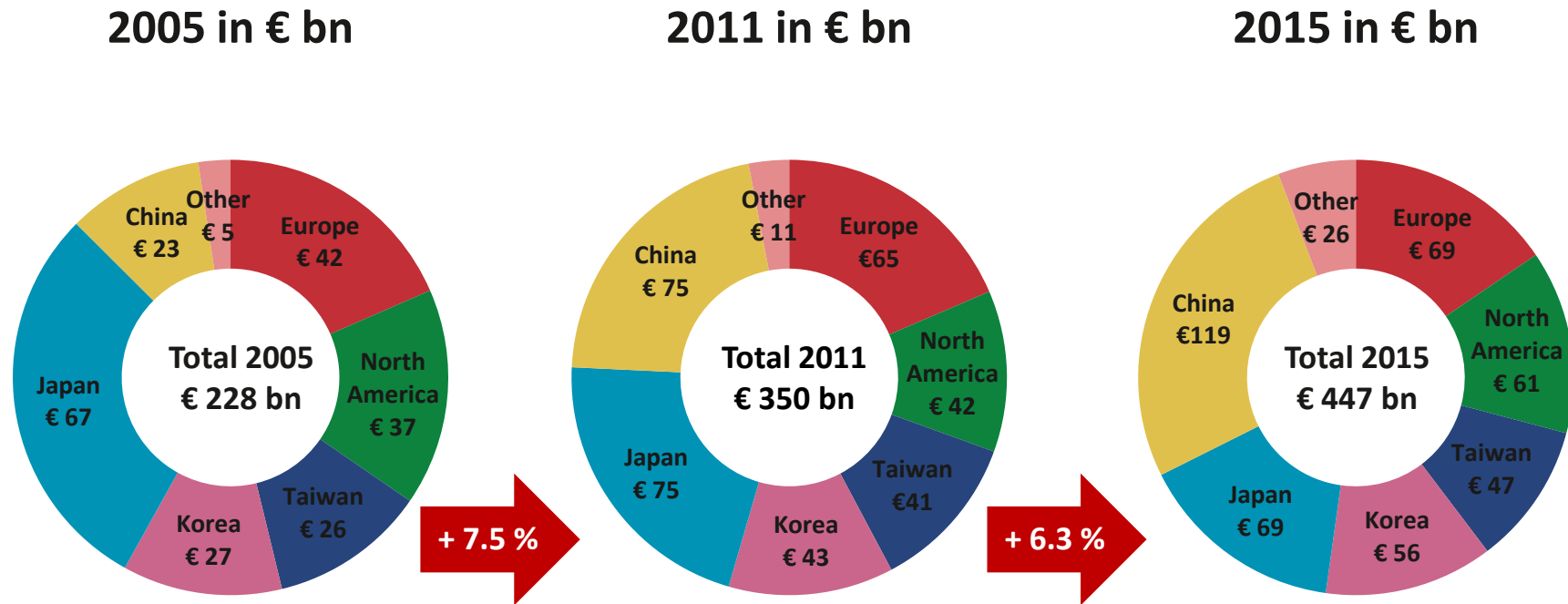
*"The use of intelligently networked pollution detectors will give us unprecedented control over air and water quality."*

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# European Photonics - a strong investment case

## Production Volume on Euro Basis\*



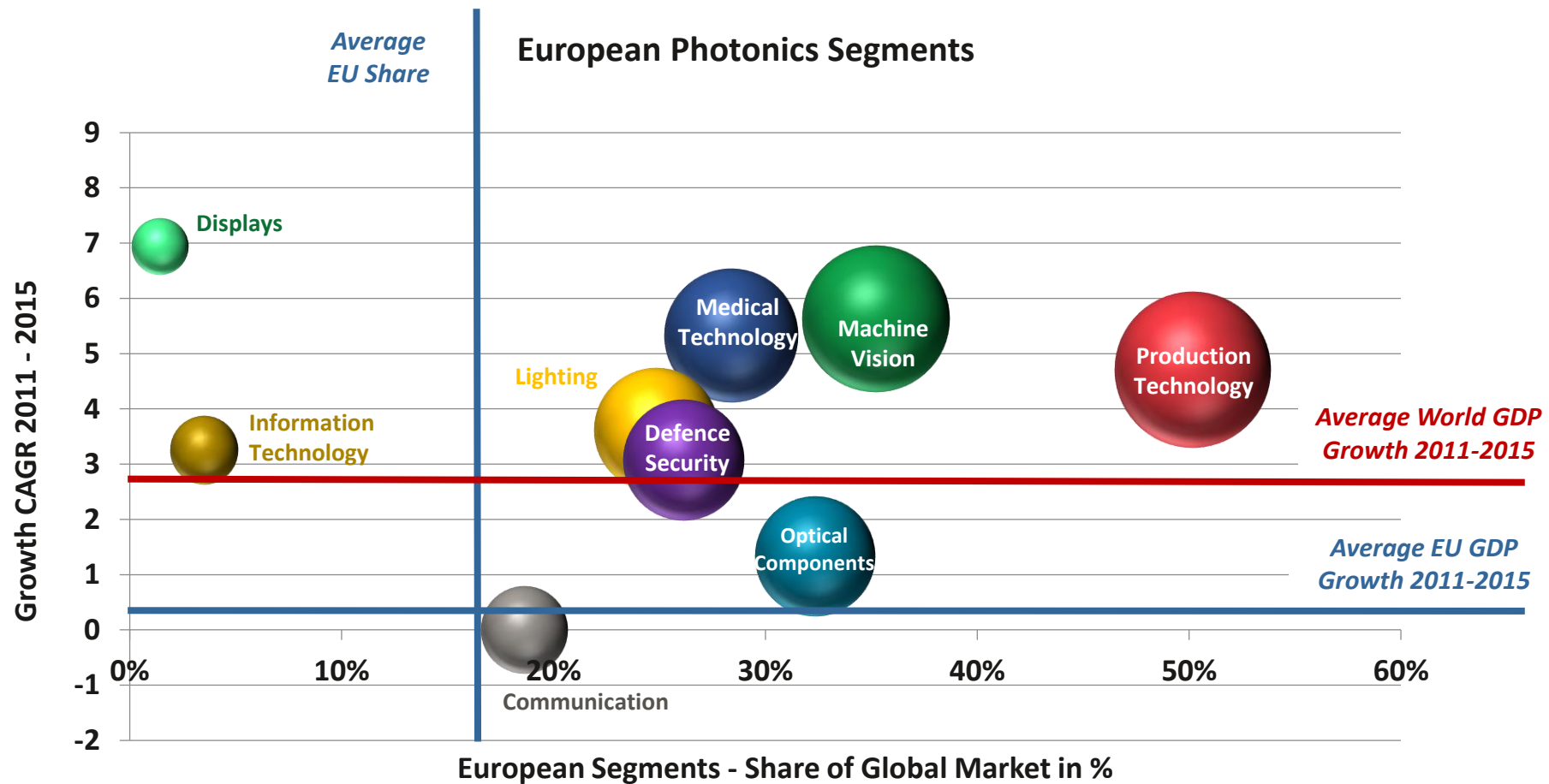
\* with Photovoltaics which is not subject of the PPP

Source: Optech Consulting Market Research Study 24.1.2017

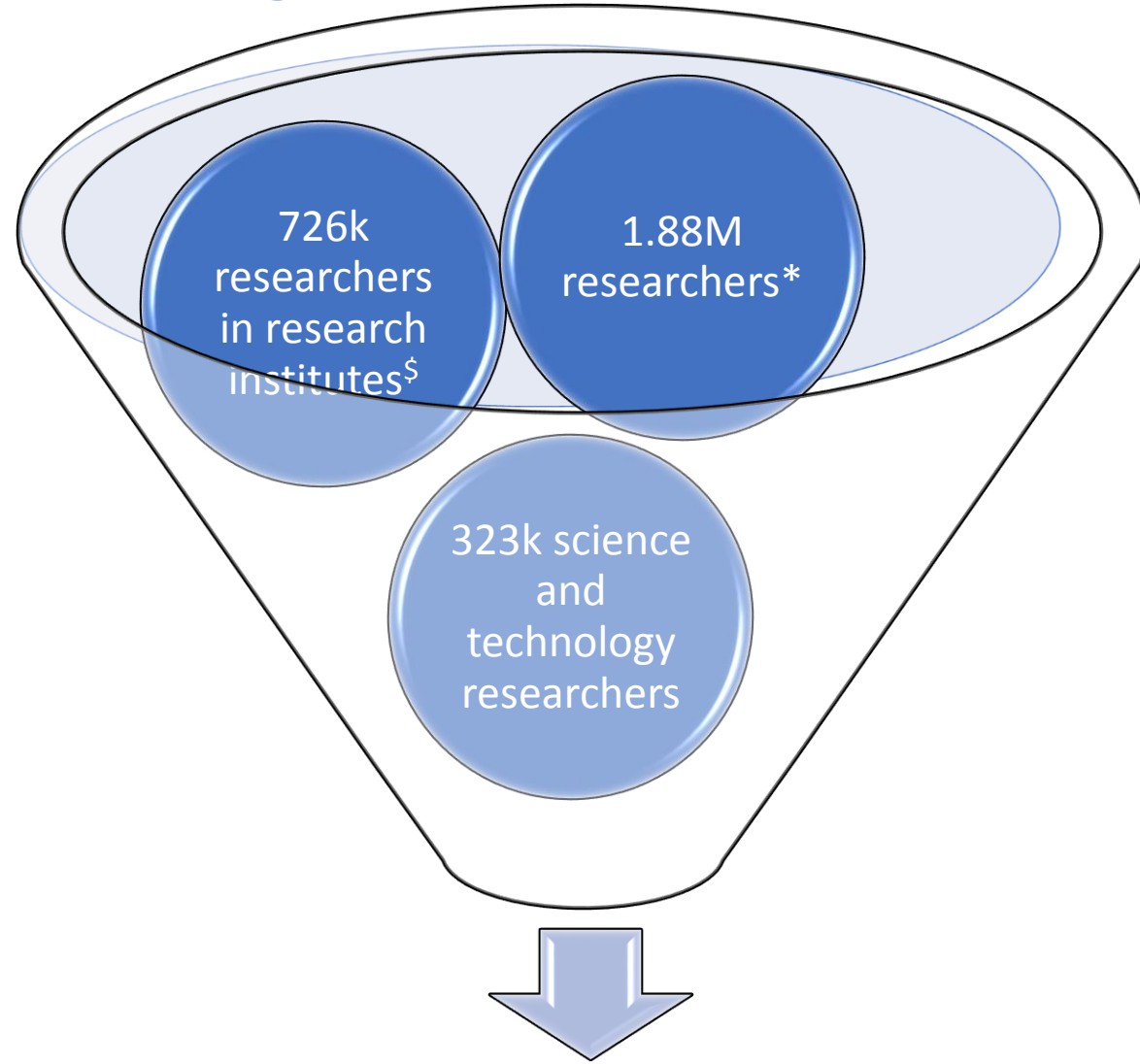


# Europe is an industry market leader in photonics segments where optics is a key element

*Outgrowing global and European GDP*



# Europe's Innovation Challenge



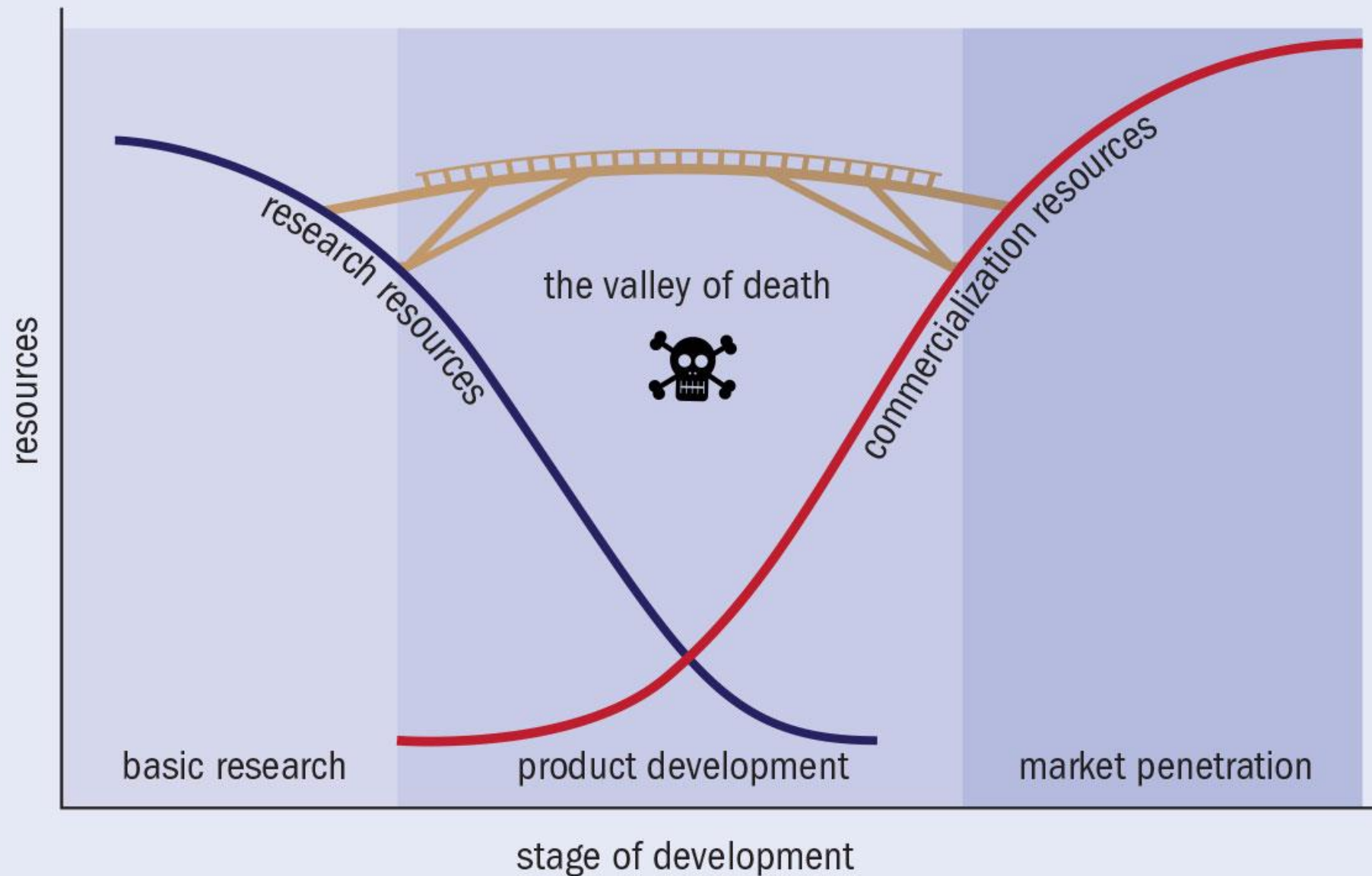
Superb Research Base

\* In EU28 in 2015

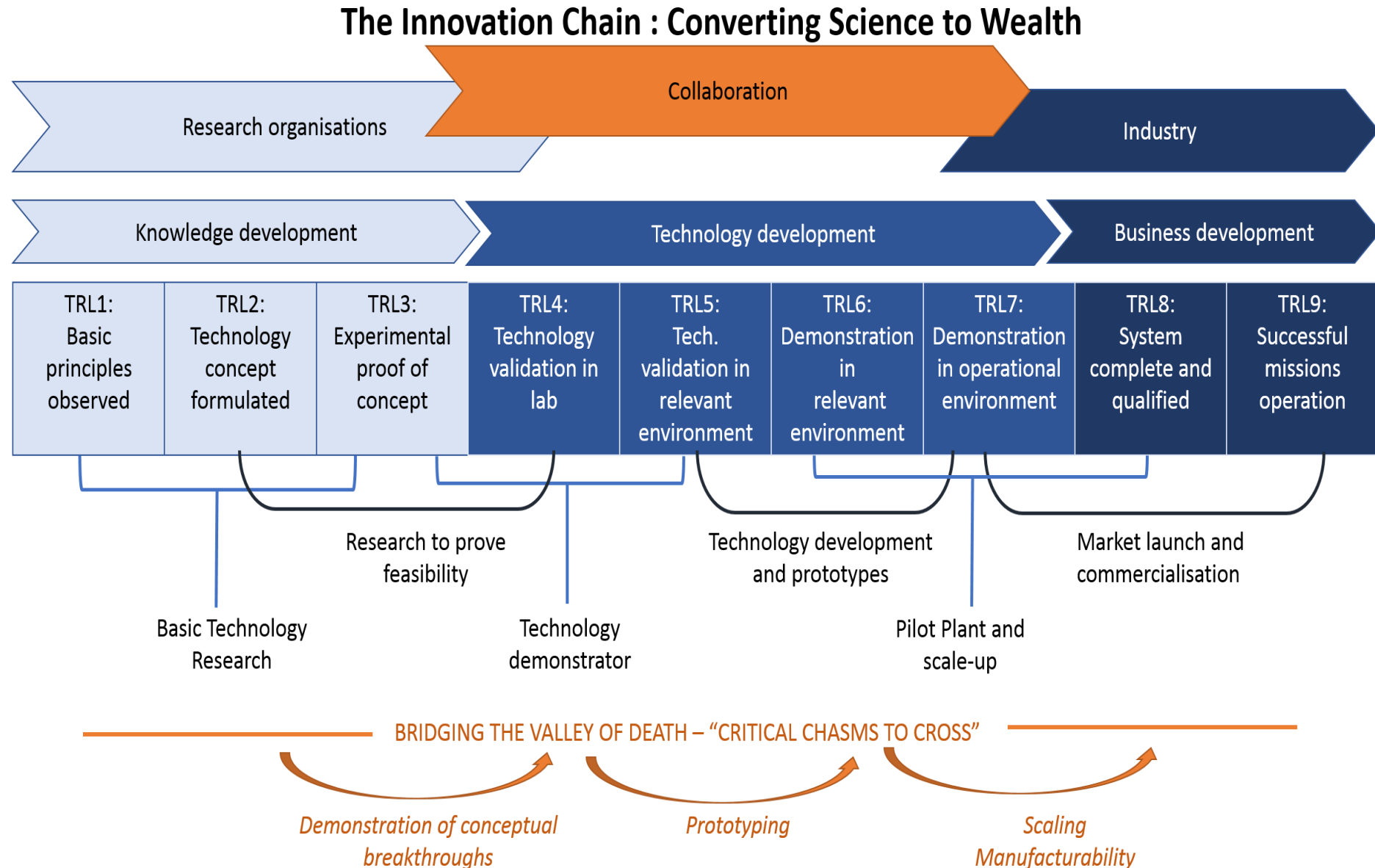
\$ In EU28 in 2014



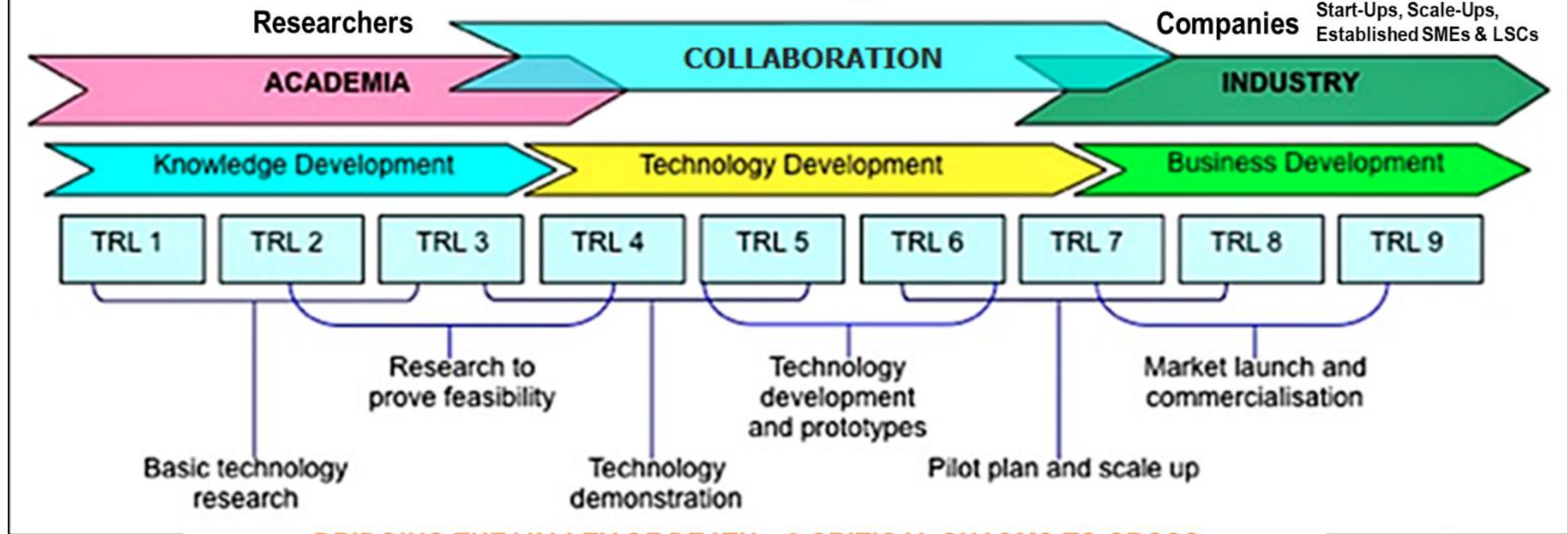
# The European research ecosystem struggles in bridging the innovation valley of death



# Technology Readiness Levels (TRLs) and the chasms in the innovation valley of death



# The Innovation Chain: Converting Science into Wealth



## BRIDGING THE VALLEY OF DEATH – 3 CRITICAL CHASMS TO CROSS

Demonstration of conceptual breakthroughs

Simulating / Prototyping

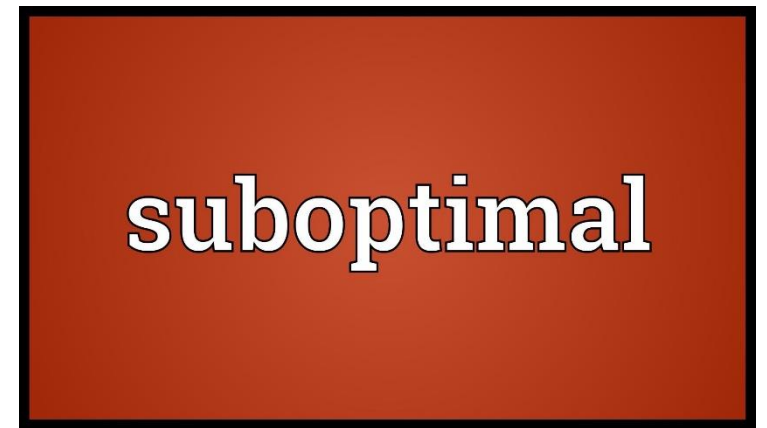
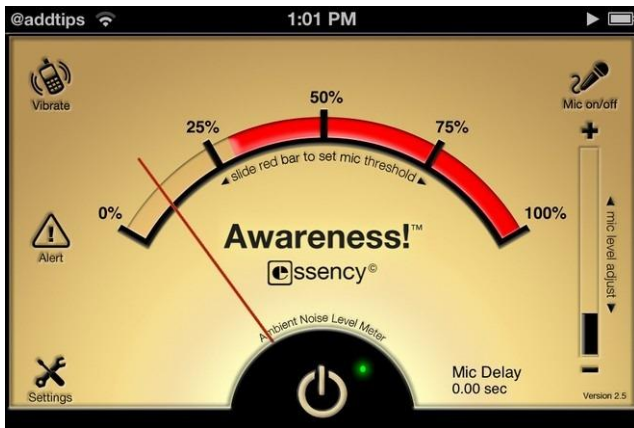
Scaling Manufacturability



TOWARDS AN INTEGRATED INNOVATION ECOSYSTEM



# Current barriers for researchers in Europe to demonstrate their conceptual breakthroughs using advanced photonics



Huge number of researchers that could benefit from photonics are not even aware about it

Researchers have limited access to advanced photonics technology

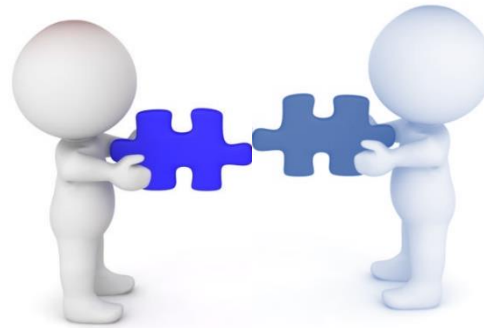
No access to advanced photonics technology implies suboptimal solutions and no deployment

# Current barriers for researchers in Europe to demonstrate their conceptual breakthroughs using advanced photonics



Grants to support fundamental research but limited grants to bridge from basic research to applied research and innovation aligned with commercial enterprises

Academia      Industry



Lack of systematic Europe-wide vehicle to create integrated innovation ecosystem between academia and industry

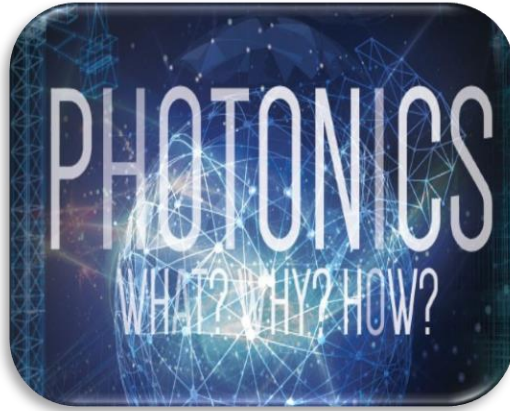


Lack of services based on mature technology platforms to researchers in order to deploy technologies effectively



**Photonics  
Technology  
Access for  
Researchers**

# ACTPHAST 4R : lowering the innovation barriers



provide access to advanced photonics platforms  
for photonics and non-photonics  
researchers



to prototype their  
proven conceptual breakthroughs



one-stop-shop access to  
mature technologies and expert coaches



cross-fertilization  
with photonics is key



# Access to photonics and non-photonics researchers



- Providing access for both **photonics** and “**non-photonics**” researchers
- Many early stage concepts of new applications are **cross-KET**
- **Cross-fertilisation** of photonics with other KETs is a central component of innovation in the new digital economy.

# Starting point : Conceptual breakthroughs

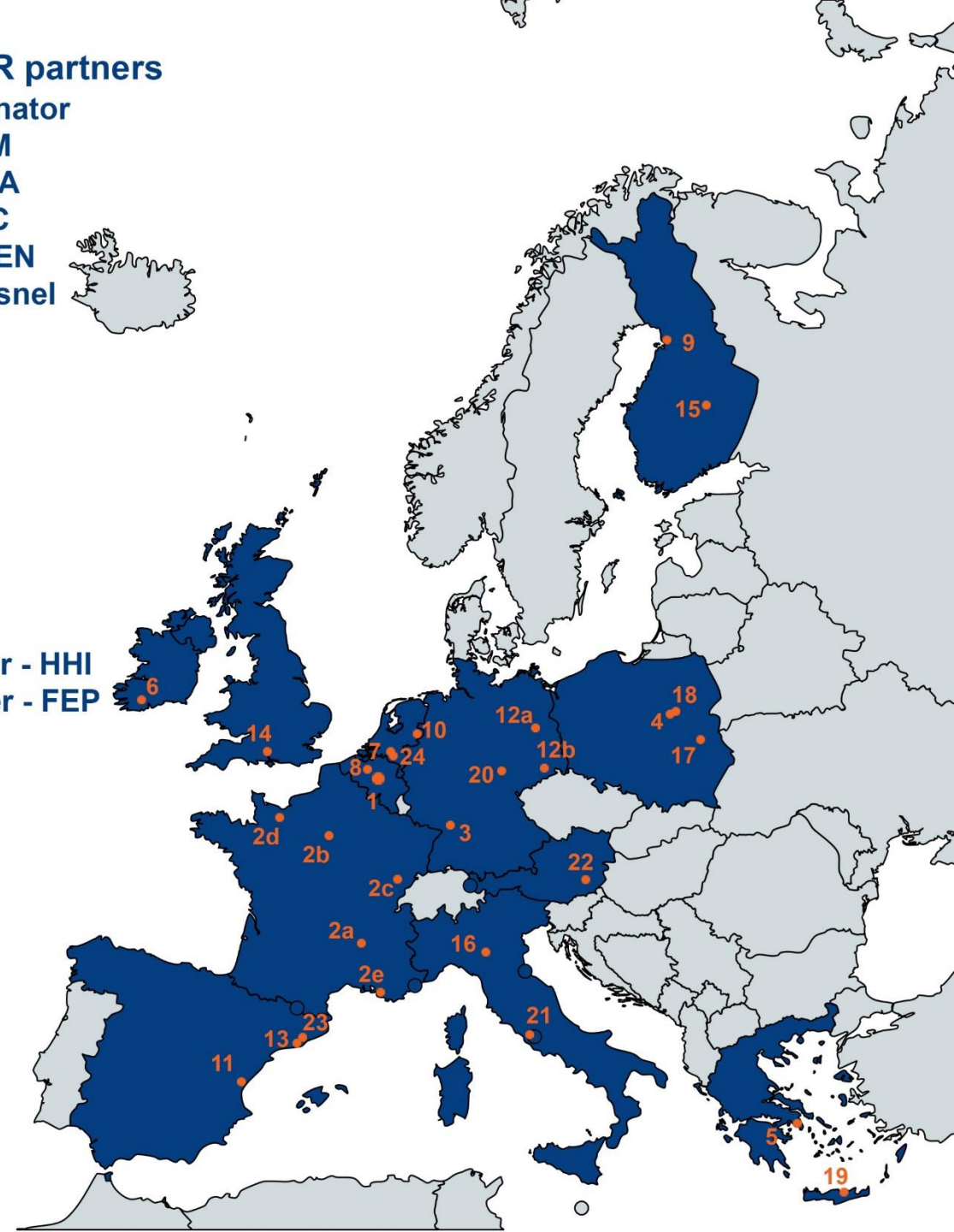


- Enabling researchers to work with advanced photonics technologies where the TRL of these **technologies is already proven**
- However the TRLs of the researchers' concepts for applying these technologies are still at an early stage and they need access to the advanced technologies in order **to demonstrate their conceptual breakthroughs by turning them into prototypes**

**ACTPHAST 4R:**  
one stop-shop access  
to mature  
technologies,  
experts, and coaches  
from  
24 European  
partners

- **ACTPHAST 4R partners**

1. VUB - coordinator
- 2 a. CNRS - UJM
- 2 b. CNRS - IOTA
- 2 c. CNRS - UFC
- 2 d. CNRS - CAEN
- 2 e. CNRS - Fresnel
3. KIT
4. WUT
5. ICCS
6. UCC
7. TU/e
8. IMEC
9. VTT
10. LIO
11. UPV
- 12 a. Fraunhofer - HHI
- 12 b. Fraunhofer - FEP
13. ICFO
14. ORC
15. EUF
16. CNIT
17. UMCS
18. ITME
19. FORTH
20. IPHT
21. CNR
22. JR
23. UPC
24. SPH





# More than 200 photonics experts

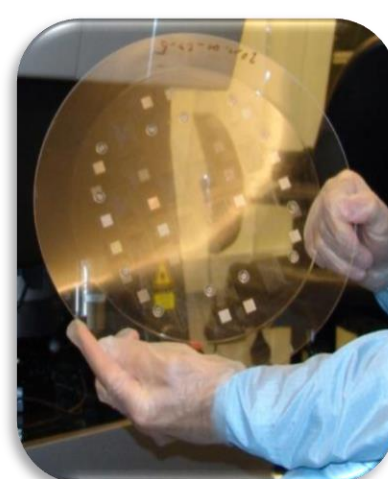




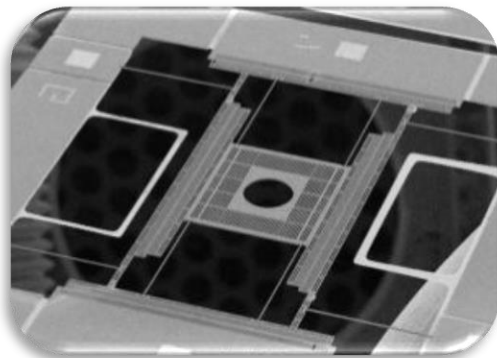
free-space optics



specialty fibers



polymer-based optics

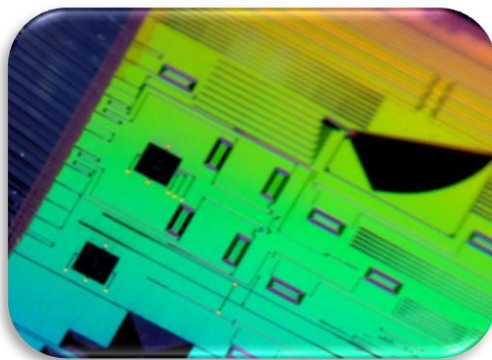


MOEMS

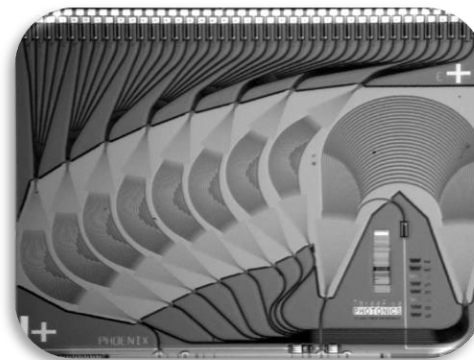
**7**  
**Technology**  
**Platforms**



SiN-SiO PICs



Si -PICs



InP -PICs



# Each technology platform is capable of supporting a full supply-chain from design to demonstrator



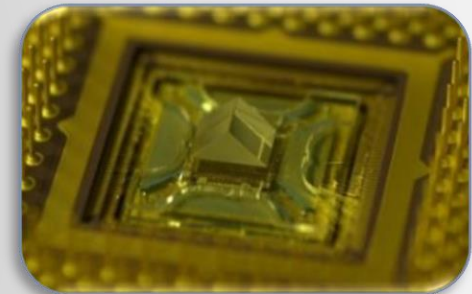
Optical Measurement and Characterization



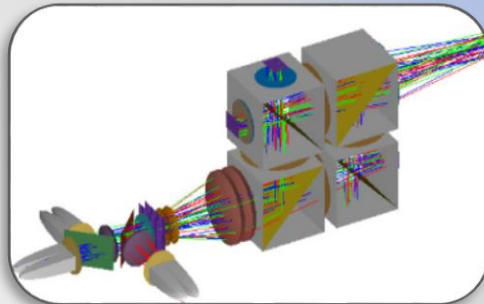
Low-Cost Low-Volume Manufacturing



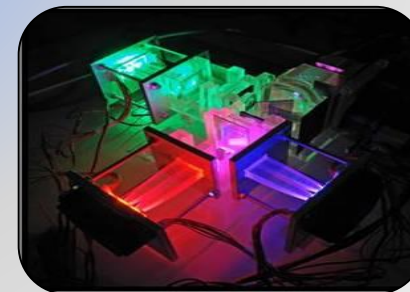
Mastering and Prototyping Technologies



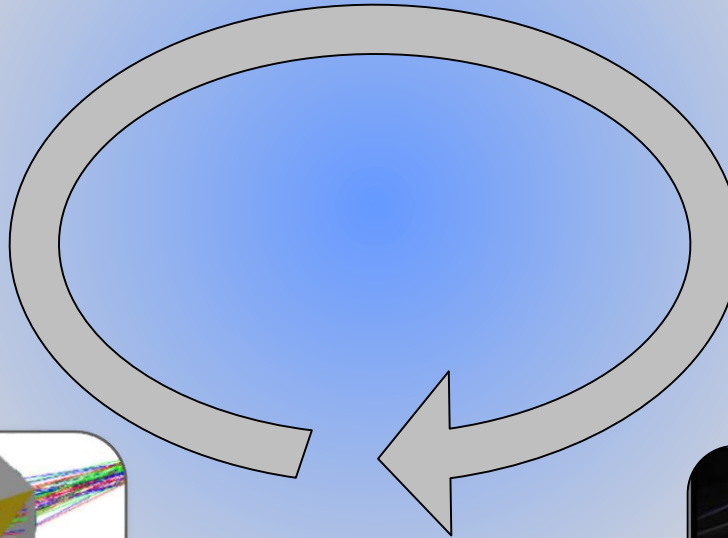
Packaging and Integration



Optical Modelling and Photonic Design



Demonstrators and Prototypes



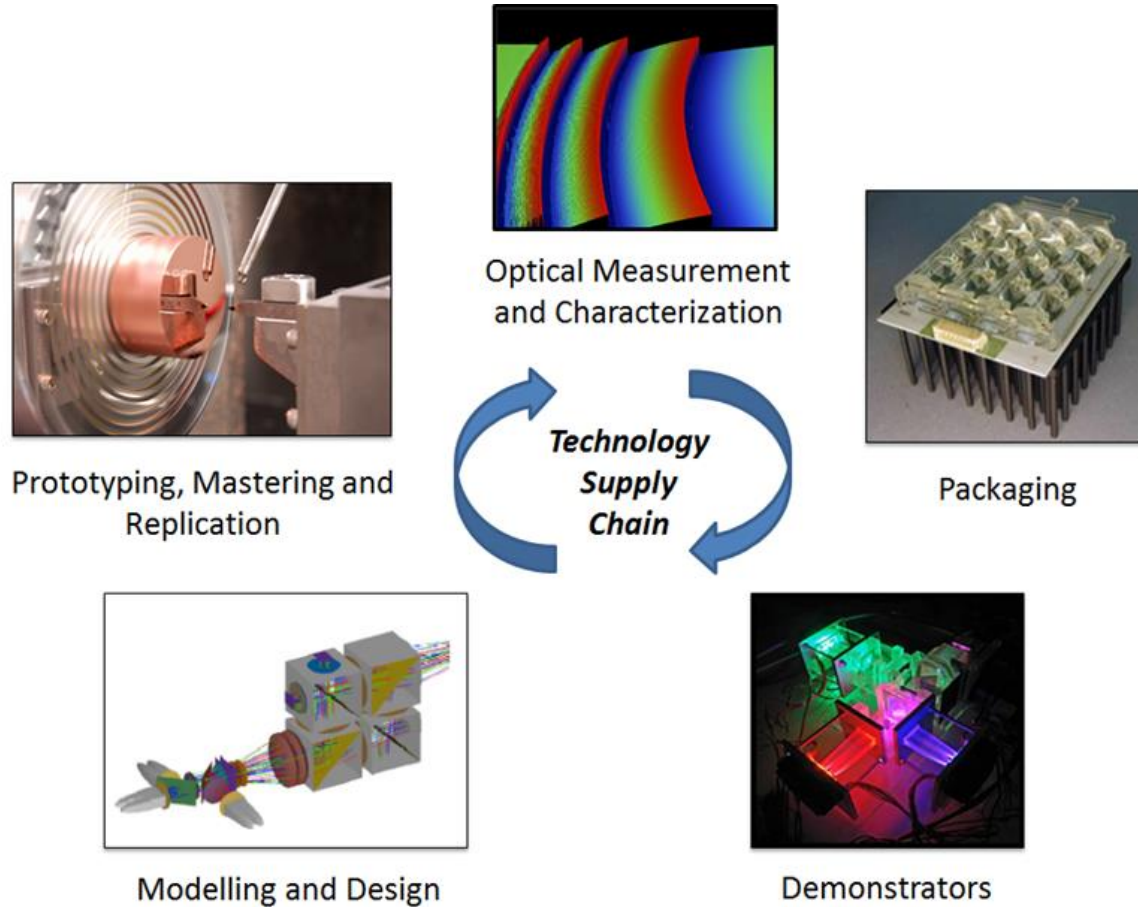


# TP1 : Free-space photonic components and systems



**Michael Vervaeke**

**TP1 responsible :**





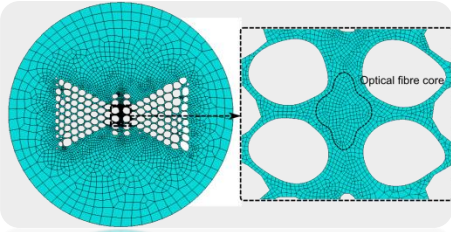
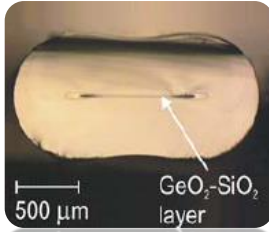


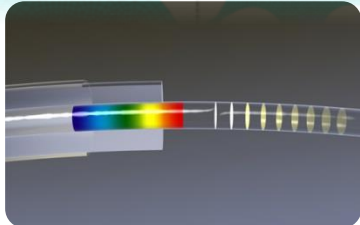
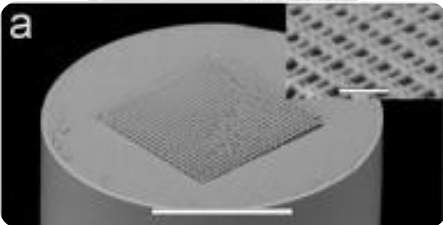


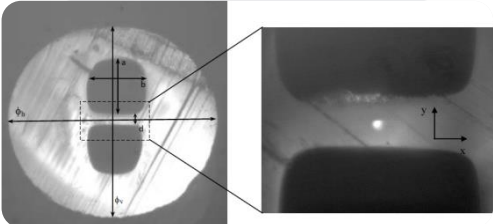
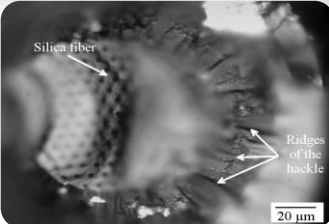


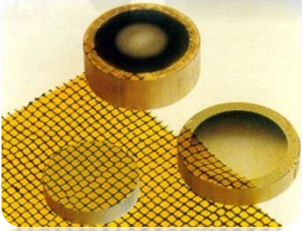
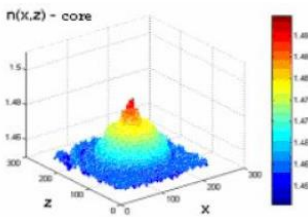
**Partners involved:**



# TP2 : Glass and polymer specialty fibres and fibre devices



**TP2 responsible:  
Francis  
Berghmans**

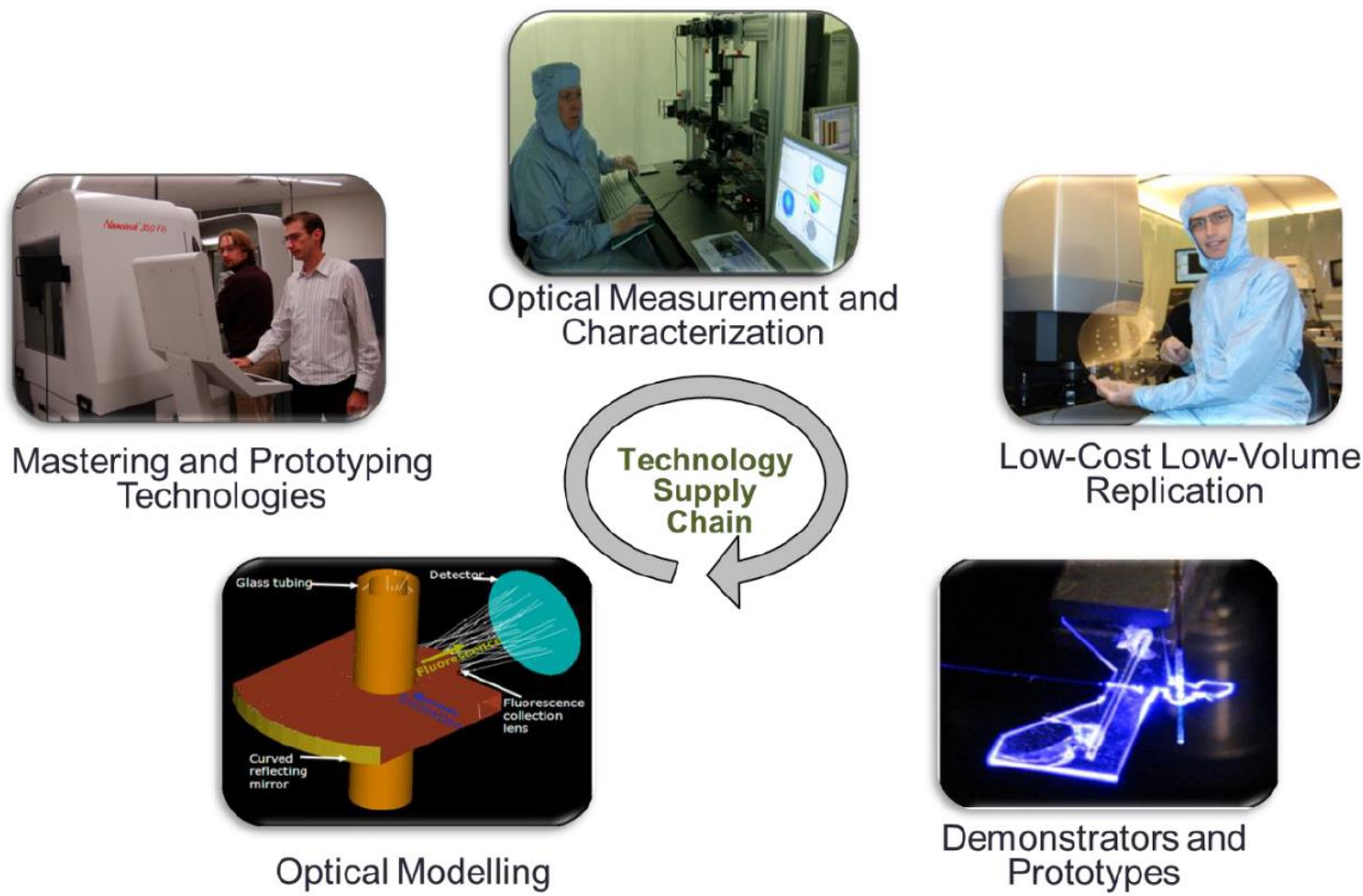
 		 <p>500 <math>\mu\text{m}</math> GeO<sub>2</sub>-SiO<sub>2</sub> layer</p>	<p>UNIVERSITY OF <b>Southampton</b></p> 
		 <p>a</p>	 <p><b>FORTH</b> INSTITUTE OF ELECTRONIC STRUCTURE AND LASER</p>
		 <p>Silica fiber Ridges of the backle 20 <math>\mu\text{m}</math></p>	
		 <p>n(x,z) - core</p>	<p><b>Warsaw University of Technology</b></p>

# TP3: Polymer-based photonic components and large-area organic-photonics



**TP3 responsible: Jurgen Mohr**

**Partners involved :**



**KIT** Karlsruhe Institute of Technology  
**STN** **IMT**  
**KNMF** Karlsruhe Nano Micro Facility  
**VUB**  
**B-PHOT** BRUSSELS PHOTONICS  
**JOANNEUM RESEARCH** MATERIALS  
**Warsaw University of Technology**  
**Tyndall** National Institute Institioid Naisiunta  
**imec**  
**VTT**  
**Holst Centre** Open Innovation by imec and TNC  
**ERISEY** **IGCS**  
**pcrl** Research Communications Research Laboratory  
**UNIVERSITY OF EASTERN FINLAND**  
**Fraunhofer**



# TP4 :Micro-Opto-Electro-Mechanical Systems



TP4 responsible: **Nadège Courjal**

Partners involved :



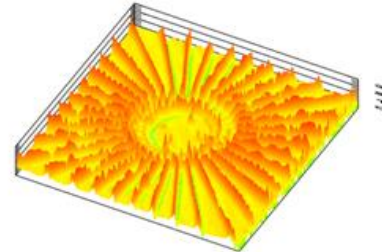
BRUSSELS  
PHOTONICS



**Warsaw University  
of Technology**



**4. static & dynamic  
characterization of  
MEMS and MOEMS**



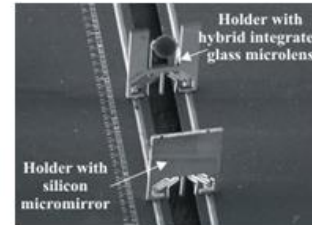
MEMS/MOEMS Characterization

**3. heterogeneous &  
hybrid 3D  
integration and  
packaging of  
MOEMS**

**2. integration of  
MOEMS with  
micromachining  
technologies**

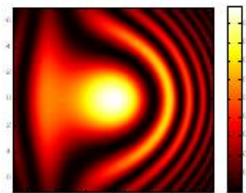


Micromachining

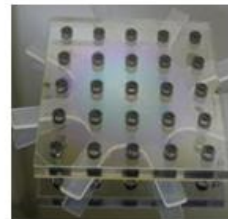


3D Integration

**1. adapted design &  
simulation of MEMS,  
microoptical components  
and systems**



Design



Demonstration

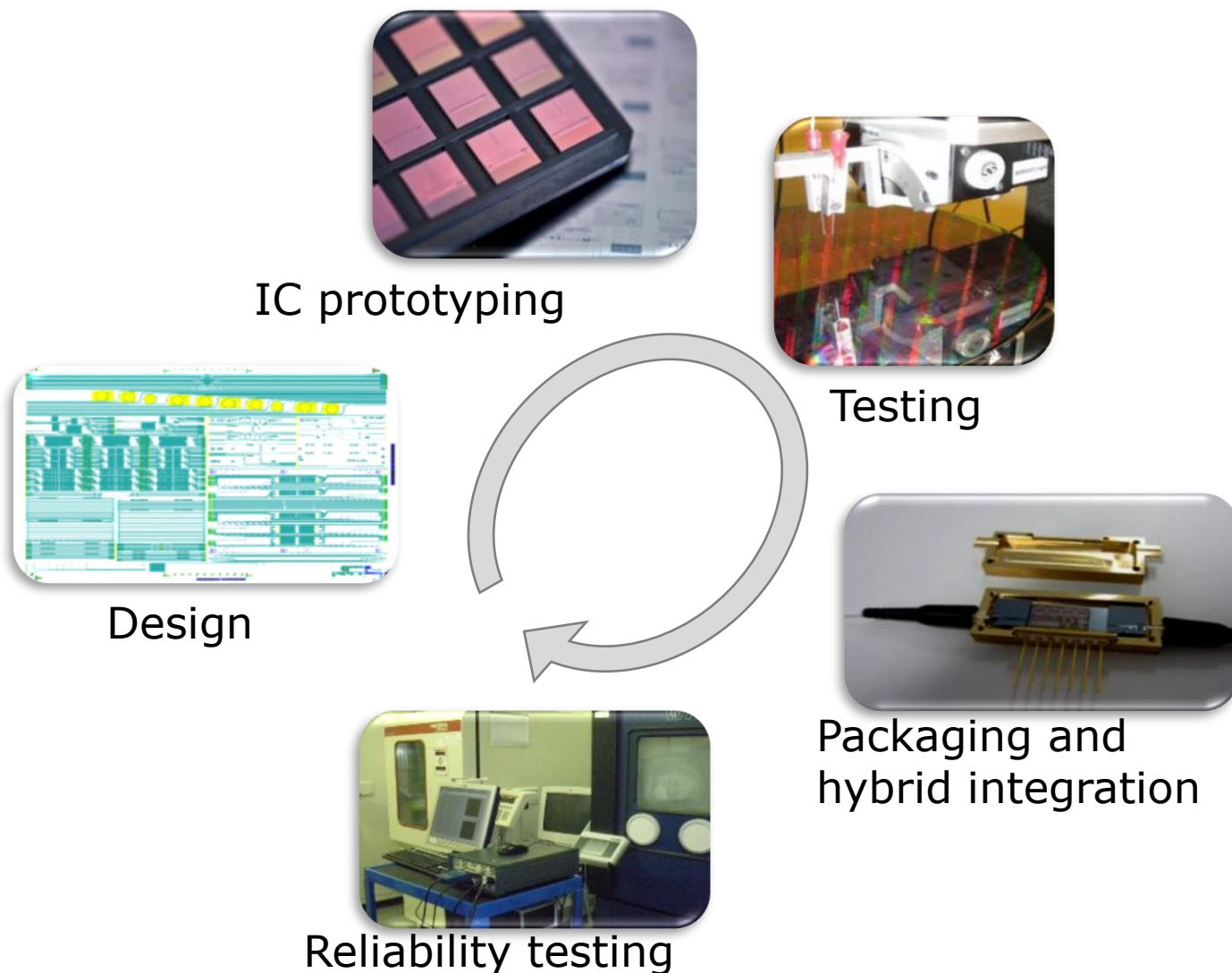
**6. implement & test  
the functional  
demonstrators**

# TP5 : Silicon Photonic Integrated Circuits



TP5 responsible: **Dries Van Thourhout**

Partners involved :

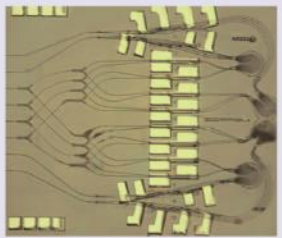




# TP6: InP-based Photonic ICs



**Optical switching**



4x4 space and wavelength selective switch

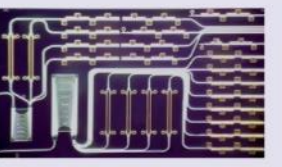


Fast optical switch matrix

**Fiber to the home**

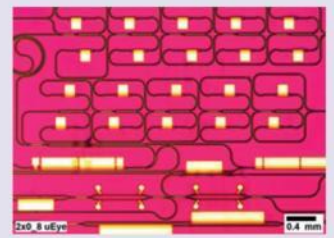


WDM receiver

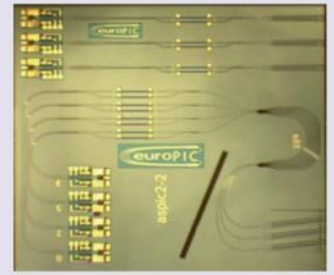


WDM transmitter

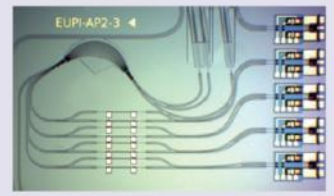
**Fiber sensor readout**



Brillouin strain sensor readout

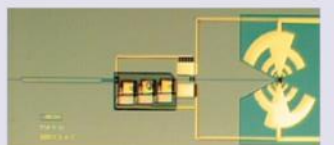


Fiber Bragg Grating readout

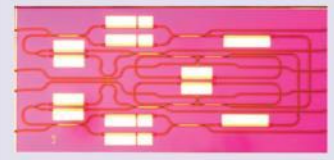


Fiber Bragg Grating readout

**THz Optical to RF converter**



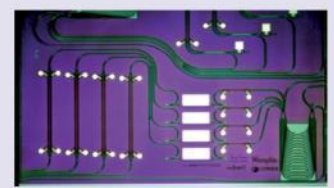
**Variety of lasers**



Widely tunable ring laser



Variable repetition rate pulse laser

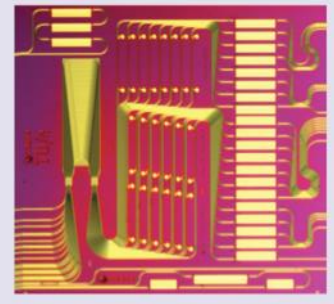


Filtered-feedback multi-wavelength laser



tunable laser with integrated MZI modulator

**Medical and bio-imaging**



Pulse shaper for bio-imaging

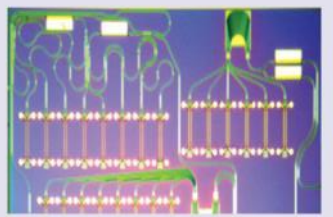
**Optical data handling**



All-optical regenerator for constant envelope WDM signals

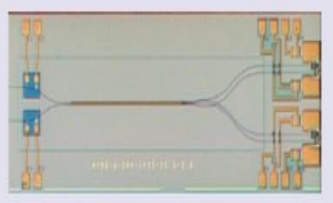


WDM to TDM Trans-Multiplexer



Pulse serialiser

**QPSK receiver**



**TP6 responsible: Kevin Williams**  
**Partners involved:**





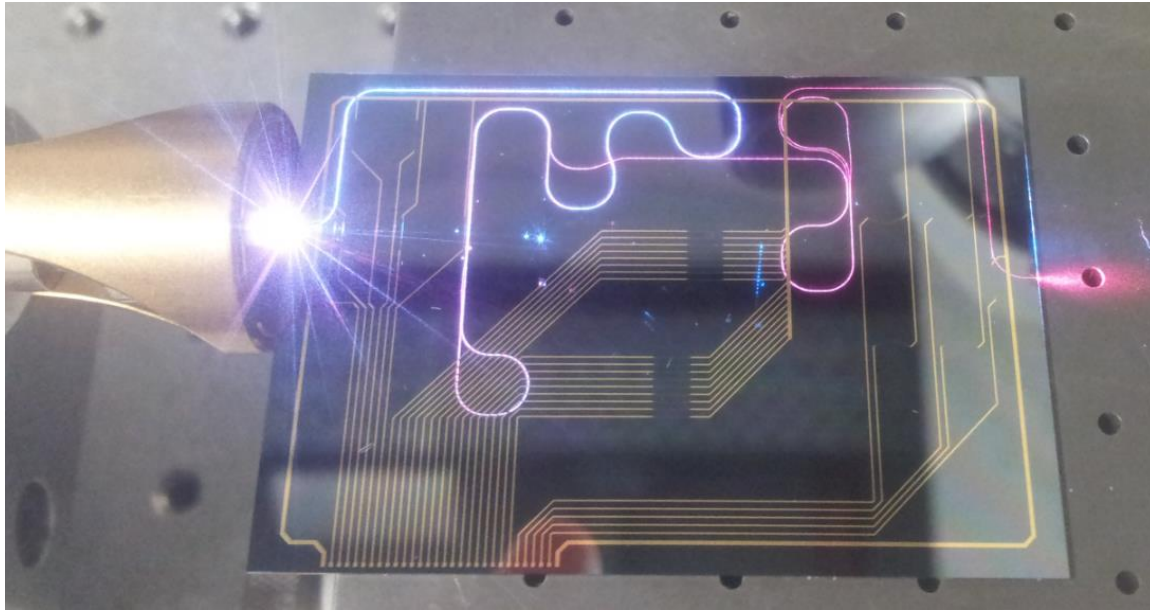
# TP7: Si<sub>3</sub>N<sub>4</sub> and SiO<sub>2</sub> passive waveguide technologies



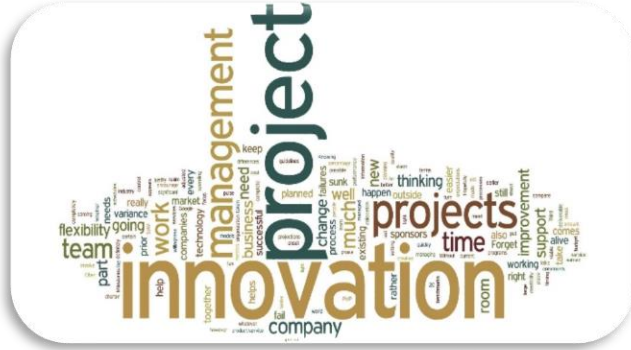
**TP7 responsible:**

**Arne Leinse**

**Partners involved:**



# ACTPHAST 4R : the basic concept



**intensive innovation projects  
coached by photonics expert teams**



**internships to the mature  
technology platforms  
for intense in-person training**



**hands-on training  
and learning by doing**



**bring the conceptual breakthrough  
to TRL levels 4-5**



**business/entrepreneurial coaching  
to improve mindset  
for accelerated deployment**



**pathways  
for further deployment**

# Turning breakthrough concepts into demonstrators



- **Intensive innovation projects** between the researchers and the ACTPHAST 4R Partners
- **guided by senior experienced experts** in the relevant technology platforms
- to successfully build and **deliver demonstrators to TRL4-5** for the researchers' breakthrough concepts



# Maximizing Knowledge Transfer



- **Internship for researchers** at one or more of the ACTPHAST 4R Partners for the relevant photonics technology platforms
- to facilitate more **intense in-person training** and to stimulate higher levels of **knowledge transfer**

# Learning by doing



- Opportunity when possible for **hands-on** working by the researchers themselves with the technology platform and the advanced photonics technologies
- to facilitate enhanced “**learning by doing**” for increased technical skills and competences as well as knowledge

# Improve mindset for accelerated deployment by coaching



- Parallel **coaching** by experienced ACTPHAST 4R business development experts on the key principles of technology entrepreneurship and valorisation (**business / entrepreneurial coaching**)
- in particular covering the key principles of the **Investment Readiness Levels (IRL)** of new technologies and market-oriented applications aligned to TRL advancement
- to help create an **improved mindset for accelerated deployment** of the photonics technologies.



# Pathways for further development of demonstrators



- Introducing researchers through ACTPHAST 4R to the **pathways for further development** of their **demonstrators**
- through **ACTPHAST 4.0** and the **Pilot Lines**, thereby facilitating improved transfer of scientific breakthroughs to industry
- **strengthening the European innovation ecosystem** and improving cross-fertilisation of advanced photonics technologies across multiple domains and applications.



# A COMPREHENSIVE EUROPEAN INNOVATION ECOSYSTEM



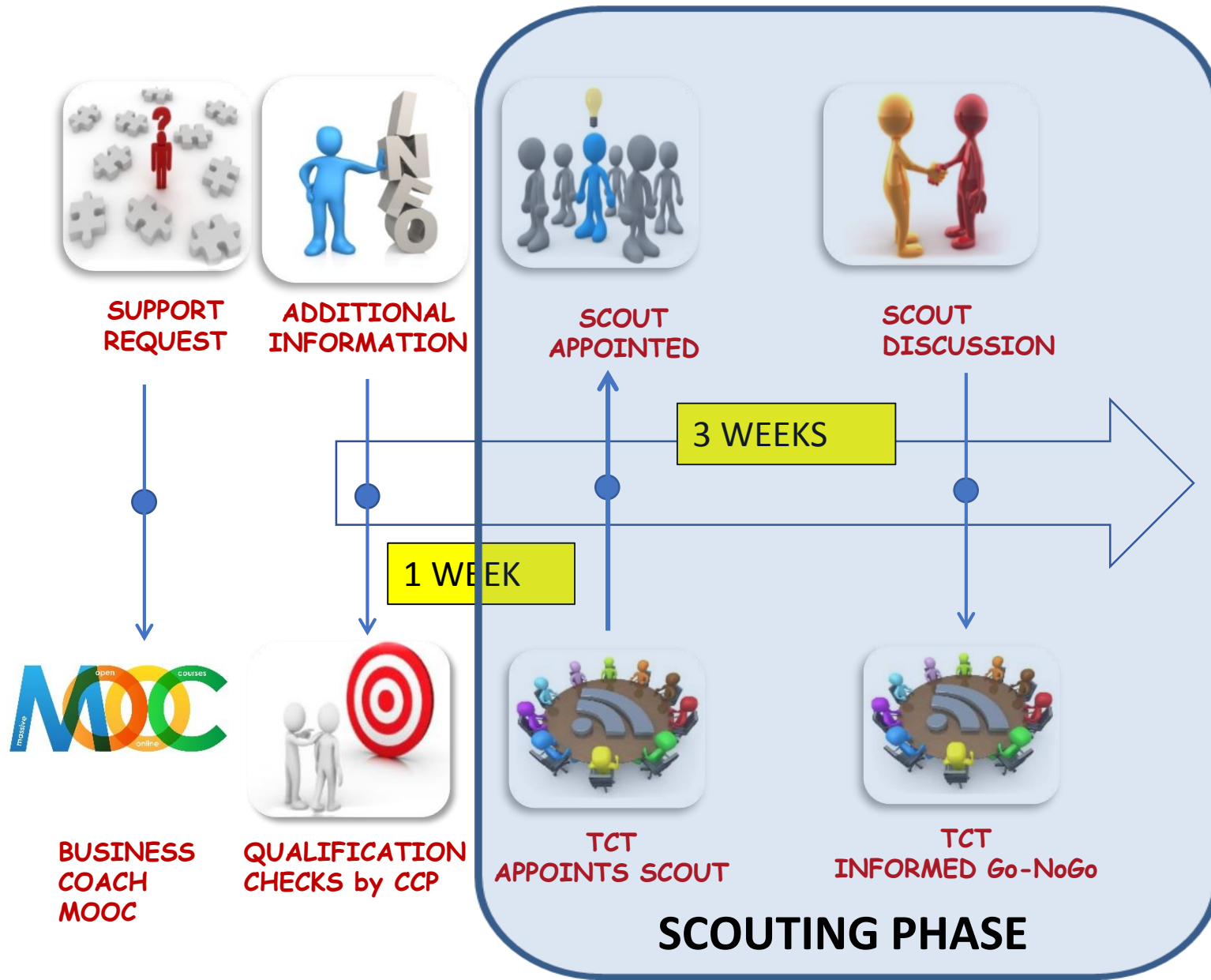
BRIDGING THE VALLEY OF DEATH – “CRITICAL CHASMS TO CROSS”

*Demonstration of conceptual breakthroughs*

*Prototyping*

*Scaling Manufacturability*

# From “first contact” to “project host appointment”



## PHASE 1: SCOUTING

- Discuss the innovation request
- Can ACTPHAST 4R help?
- Maturity of conceptual breakthrough
- Commitment of researcher
- Intellectual Property
- TRL level
- Supporting letter from PI
- Potential impact

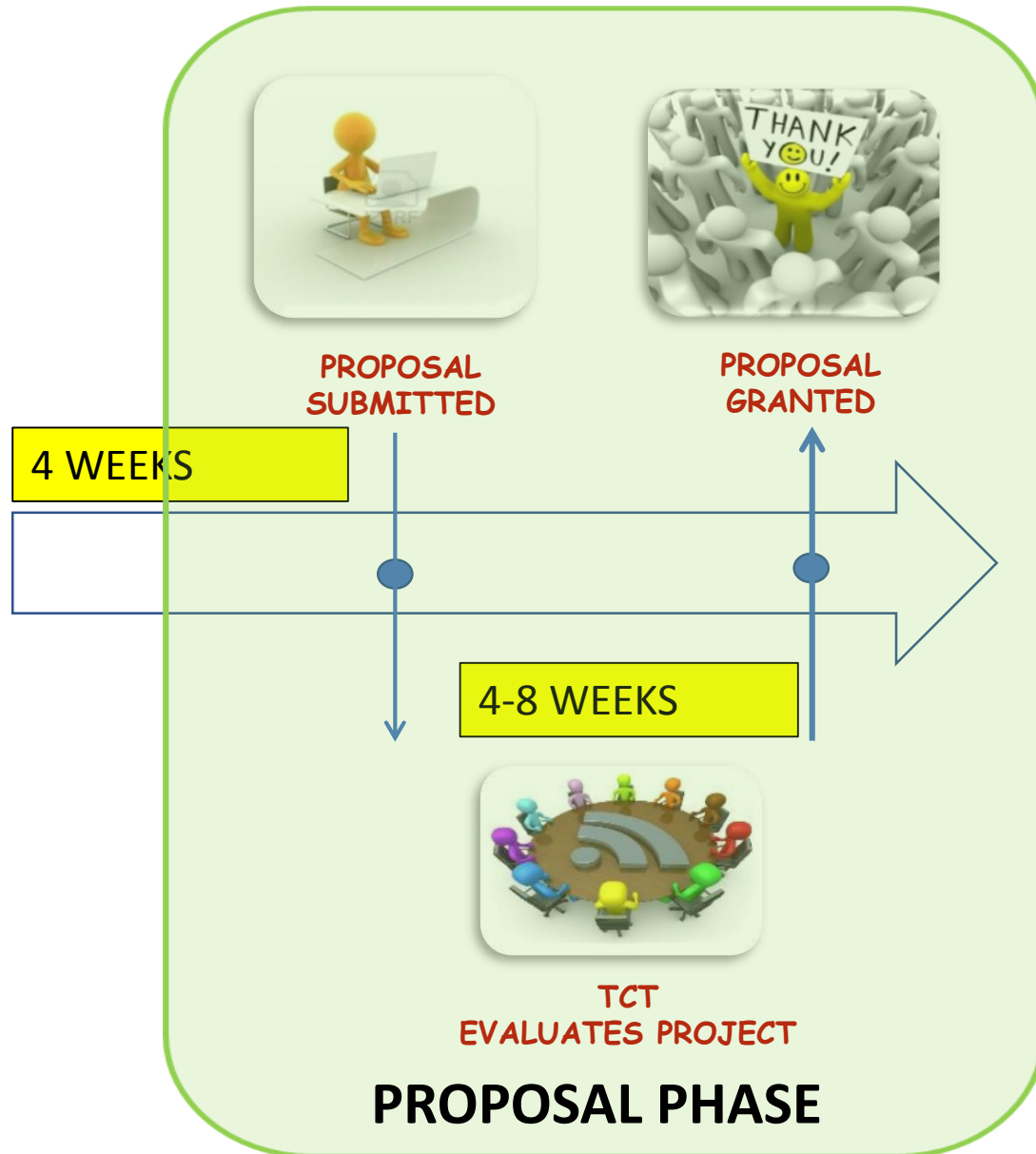


# ■ LEAN CANVAS MODEL



<p>■ <b>Problem</b> <i>List your top 1-3 problems</i></p> <p><b>Existing Alternatives</b> <i>List how these problems are solved today</i></p>	<p>■ <b>Solution</b> <i>Outline a possible solution for each problem</i></p>	<p>■ <b>Unique Value propositions</b> <i>Single, clear, compelling message that states why you are different and worth paying attention.</i></p>	<p>■ <b>Unfair Advantage</b> <i>Something that cannot easily be bought or copied.</i></p>	<p>■ <b>Customer Segments</b> <i>List your target customers and users.</i></p> <p><b>Early Adopters</b> <i>List the characteristics of your ideal customers.</i></p>
<p>■ <b>Key Metrics</b> <i>List the key numbers that tell you how your business is doing</i></p>	<p>■ <b>Channels</b> <i>List your path to customers (inbound or outbound)</i></p>	<p>■ <b>Cost structure</b> <i>List your fixed and variable costs.</i></p>		<p>■ <b>Revenue Streams</b> <i>List your sources of revenue.</i></p>

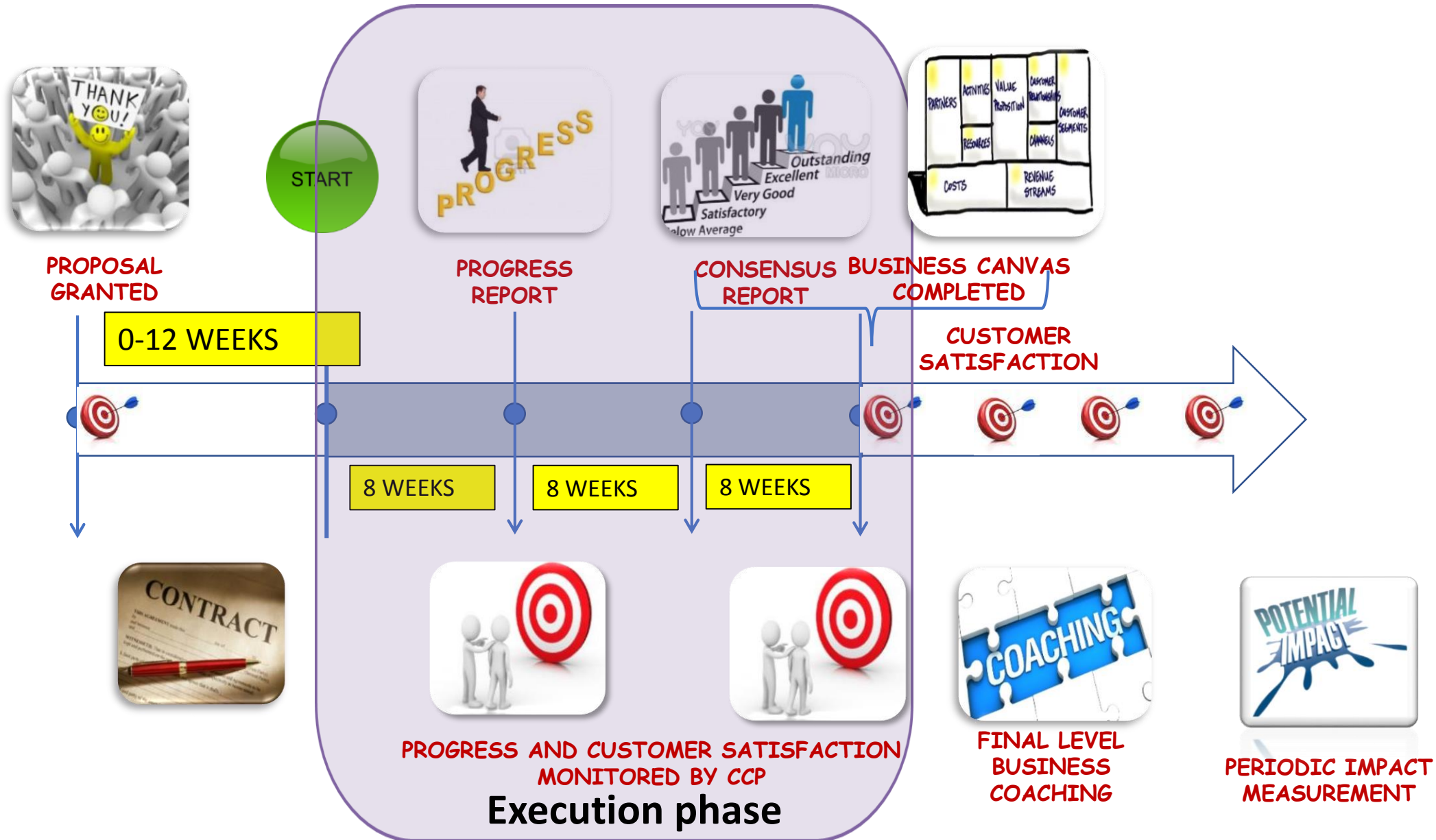
# Project proposal phase through interaction with your host



## PHASE 2: PROPOSAL

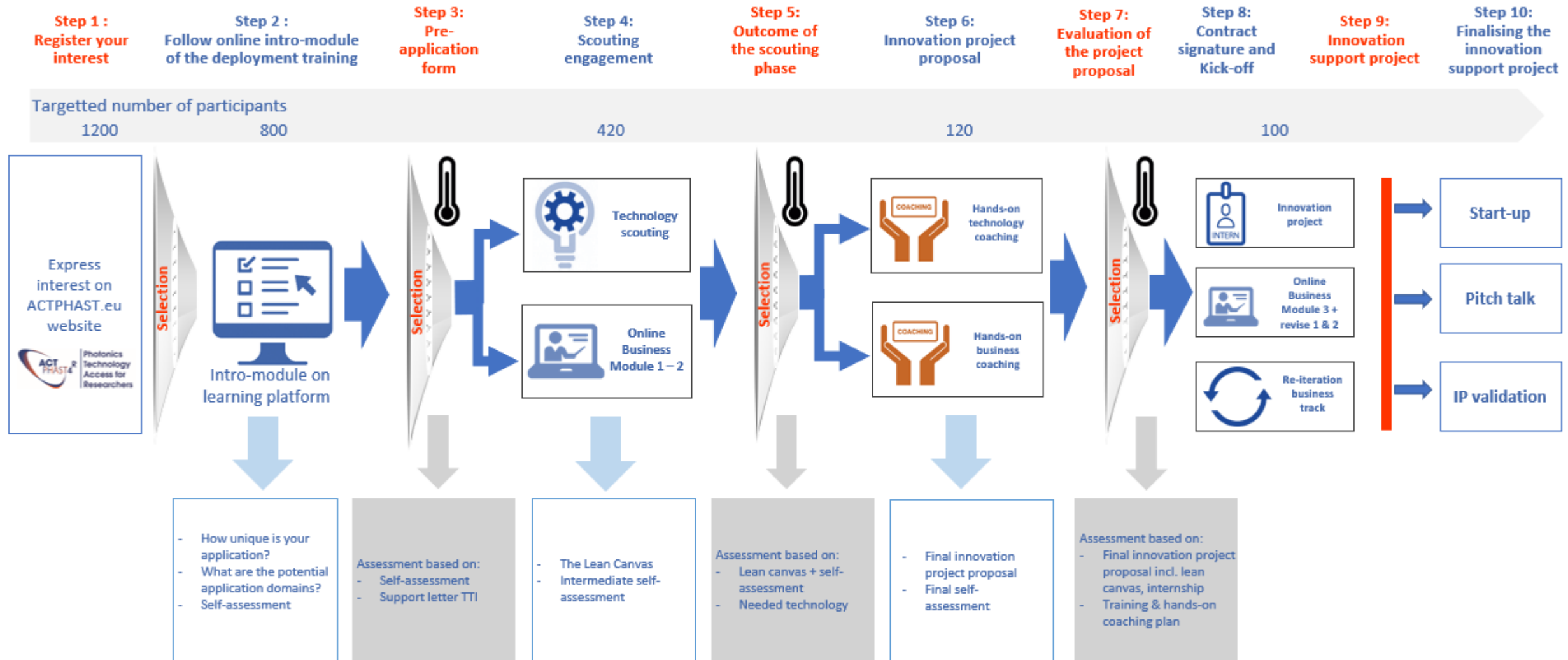
- Researcher in concert with the host writes proposal
- TCT evaluates proposal
- Focus on
  - Role of researcher and role of the host
  - Goals of the innovation project
  - Target of knowledge gain through the project
  - Description of the demonstrator
  - Description of the internship and the hands-on

# “Execution phase” and “impact measurement”





# Summary of the steps to successful photonics innovation



**Innovation support for researchers is subsidized  
for strongly committed research organisations**

**PROJECT COSTS BELOW 30K€**

**100%**

**SUBSIDIZED**

**PROJECTS COSTS ABOVE 30K€**

**75%**

**SUBSIDIZED**

# Who is eligible for what ACTPHAST support?

- MOOC is always offered for European researchers
- Scouting can be funded except for photonics researchers from ACTPHAST
- Project support costs can be covered up to 100K Euro for transnational projects except when the researchers are from ACTPHAST
- Researchers will pay always for their travel and accommodation related to internship.
- The access center can also host researchers that have EU grants but the project cost have to be covered by the EU grant. ( no double funding)





40 000 researchers increased photonics awareness / 1200 high quality support requests



800 researchers have increased knowledge in technology entrepreneurship



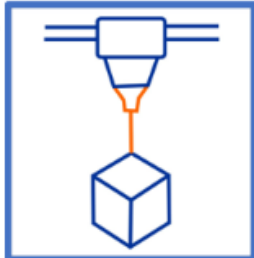
400 researchers receive focused technology coaching



100 innovation projects with internships and hands-on



100 researchers have intensive business coaching for completion of Business Canvas model



80 new demonstrators with potential for scaling



60% cross-KET projects by non-photonics researchers



40% projects by photonics researchers



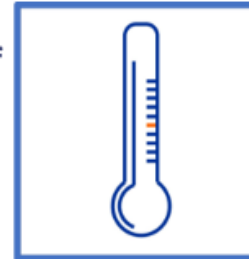
100% transnational projects across 20 member states



6 months average project duration



Cross-fertilization of projects across 10 different non-photonics domains



TRL advancement by 2 levels per innovation project



Overall satisfaction level: 4/5 "Very Good"



R&I expenditure leverage of factor 2



50 joint publications



30 IP depots / patent applications or strengthened patents



20 IP transfer and technology licensing agreements with industry



Early incubation of 10 spin-outs creating 50 high tech jobs



15M€ further growth capital raised (project, seed and VC funding)



Best practice models developed for innovation co-funding with 5 EU regions



## Accelerating Photonics Innovation

Want to **innovate** with **photonics**?

But don't have access to the right

**expertise** or **technologies**?

ACTPHAST 4R

Photonics  
Technology  
Access for  
**Researchers**

ACTPHAST4.0

Photonics  
Innovation  
Incubator for  
**SME's**

ACTPHAST will get you

**from Concept to Prototype....**

Faster, At Less Cost, With Greater Impact

**REGISTER YOUR INTEREST NOW**  
**ON [WWW.ACTPHAST.EU](http://WWW.ACTPHAST.EU)**



PHOTONICS PUBLIC PRIVATE PARTNERSHIP



PHOTONICS<sup>21</sup>



Photonics  
Technology  
Access for  
Researchers



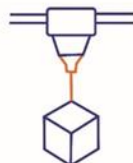
Technology coaching from  
top photonics experts



Innovation projects with  
internships  
& hands-on activities



Intensive professional  
business coaching



Demonstrators with  
potential for scaling-up

**ACTPHAST 4R**  
provides **photonics**  
and **non-photonics**  
**researchers** with  
**one-stop-shop access**  
to a wide range of  
existing cutting edge  
**photonics technology**  
**platforms** from  
Europe's top research  
centres.



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ACTPHAST provides photonics and non-photonics companies and researchers with one-stop-shop access to a wide range of existing cutting edge photonics technology platforms from Europe's top research centres.

The ACTPHAST network offers a single streamlined way to access 200 of the best experts and technologies from 24 of Europe's leading photonics research institutes, covering the entire supply chain to accelerate the demonstration of exciting new scientific breakthroughs towards a working prototype, and beyond into mass manufacturing.

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A unique one-stop-shop solution for supporting photonics innovation in European