Photonics PPP
Services to European SMEs

PHOTONICS21

Contents

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1. Purpose of this brochure

This brochure presents the actions supporting the European Photonics ecosystem and its thousands of Small- and Medium-Sized Enterprises developing Photonics technologies. These actions are a fortiori supporting many more SMEs integrating these technologies in their own products already today or in a near future. The support is provided by a well organised network lead by the Photonics Public Private Partnership (PPP) and consists of national platforms, regional clusters, major laboratory infrastructures, academies and institutes. This support is based on projects designed and launched by the Photonics PPP. Many national platforms and regional clusters reaching maturity, the services developed in these projects are continued after the lifetime of these projects.

The section 2 of this brochure gives an overview of the services offered to SMEs in different Photonics PPP projects by national platforms, regional clusters and other laboratory infrastructures. More details about the European photonics, the Photonics PPP and the different projects can be found in sections 3 to 5.

The services concern:
- *The organisation of events and networking opportunities between SMEs and with end-users or with other supporting organisations.*
- *The assessment of a multitude of technical or business-related aspects of what companies are doing or intend to do. This helps them reaching a cutting-edge position in the tough global competition.*
- *The development of the innovation power of SMEs by improving their internal functioning and through an easier and more effective access to expert support and top lab infrastructures throughout Europe.*
- *Actions allowing a quicker access to technology, prototyping, markets, funding, experts and information.*

Some of these services are also addressing the public including children, students and actors outside photonics such as decision-makers. Photonics still needs an increased visibility and the growth of the photonics ecosystem strongly depends on a proper skills supply and political backing.

2. Photonics projects for SMEs

2.1. Services for SMEs

A vast majority of the about 5000 European companies active in the field of photonics are small- and medium-sized enterprises (SMEs). The definition of a small and medium-sized enterprise (SME) is that the enterprise employs less than 250 persons and has an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.[1] Many photonics companies with less than 250 employees are not considered as SMEs because they are belonging to another larger company or are part of a group of companies. With about 5000 companies the European photonics industry is SME driven. It is estimated that only about 200 companies have more than 250 employees. SMEs are therefore particularly important for the European photonics industry for the volumes they represent. They are also particularly vulnerable and quite often lack some of the necessary resources to develop their business. For these reasons, nearly all Coordination and Support Actions (CSAs) of the Photonics PPP have a clear focus on SMEs and on the different tools they need for their successful development. In this section, an overview of the services offered by the photonics CSAs projects is presented. A separate presentation of the services offered by the Innovation Action ACTPHAST is given at the end since it concerns a much larger project with a completely different organisation.
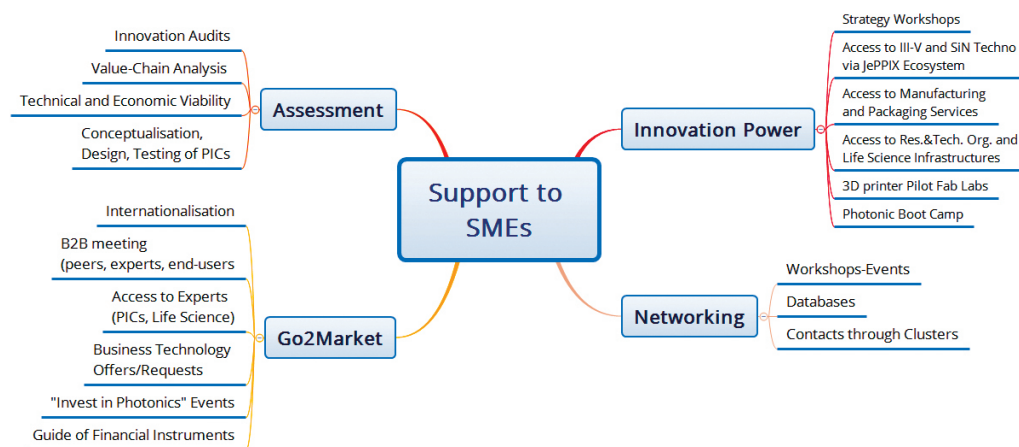

Figure 1: Overview of the type of support provided to SMEs by several Photonics PPP projects.

The supports provided by several Photonics PPP projects are structured in four main categories:

- **Assessment**: Supporting a company requires good knowledge of the technologies and products it offers. Technical feasibility and economic viability studies are efficient tools for that. The innovation potential and the value-chains are also very important aspects to analyse. Certain aspects may involve "softer" characteristics of the SMEs, e.g. management style and commitment of the employees to the objectives of the company and can be sometimes more important than the technology. PICs4All can help SMEs to assess the possibility and technical feasibility to use PICs in their products. RespiceSME supports SMEs by carrying out innovation audits and value chain analysis to assess their innovation potential.

- **Innovation Power**: A company can enhance its ability to innovate by getting access to external means such as lab infrastructures, equipment or researchers or by improving its way of working internally. For the latter, RespiceSME is organising strategy workshops for SMEs to help them developing an action plan to improve their ability to innovate based on the assessment realised with the innovation audit. ACTPHAST (see below) is providing a lot of support to power the innovation of SMEs.

- **Networking**: The organisation of events is obviously a very important part of all photonics CSA/COSME projects. Events are not only the forum where different actors can find each other; it is also usually intense moments resulting from long preparation efforts. Databases of

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[1] COMMISSION RECOMMENDATION of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (notified under document number C(2003) 1422) (Text with EEA relevance) (2003/361/EC).

companies or RTOs are part of this category "networking" since their main "raison d'être" is to connect actors throughout Europe and beyond. Photonics Clusters play an important role to entertain the networks on a day-to-day basis.

- **Go2Market**: Accessing markets and buyers is a long way with many obstacles, basically what is often called Valley-of Death. Several projects have been addressing this issue and most CSA projects have developed Go2Market Services that the clusters can propose to their members. This is also a sustainability issue for the clusters when the public financial support decreases and it becomes therefore crucial to be able to get proper incomes from services. These services need to really correspond to the most central needs of the companies.
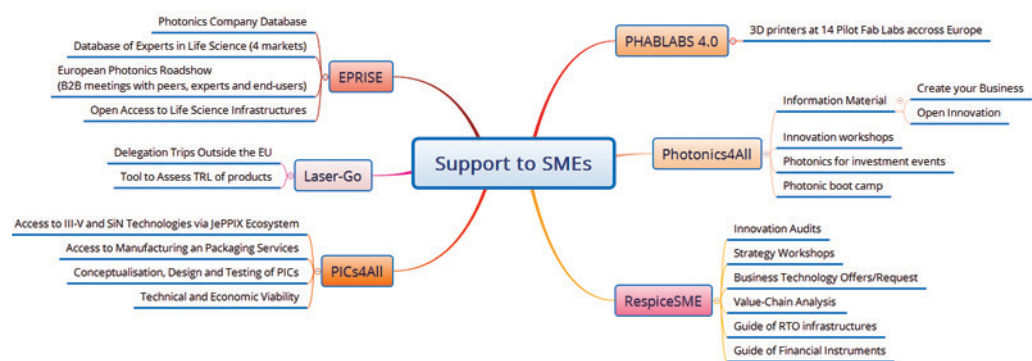

Figure 2: Overview of the support provided to SMEs by the CSA/COSME projects

RespiceSME is very instrumental for the Photonics Clusters (PCs) in Europe to improve their methods and tools in supporting SMEs. The support in RespiceSME is to provide a **toolbox** which contains: a) a dedicated questionnaire of **innovation audit** to analyse the innovation potential in a specific SME and a model of **strategy workshop** to develop a business innovation strategy based on a dedicated action plan; b) an access to a platform of **business technology offers/requests** to stimulate the technology transfer and business development of SMEs; c) A **value-chain analysis** to identify gaps and new opportunities in e.g. new application markets; d) a **mapping of Research and Technology Organisations (RTOs)** to allow an easy access to research for SMEs; e) a **guide of national and European financial and funding instruments** to support the implementation of the innovation business strategy of SMEs.

EPRISE is capitalising on a previous project, OASIS, which was connecting life science infrastructures with biophotonics SMEs in Europe. EPRISE is going further in strengthening the European biophotonics by **engaging regions** in a joint effort and encouraging them to collaborating and taking benefit of co-funding between structural funds and Horizon2020 funds. In addition to the expected momentum gained through the regional involvement, the ***European Photonics Roadshow*** will provide a powerful support to the SMEs with large networking opportunities and access to experts help. The experts will help SMEs to more efficiently tackle difficulties specifically encountered in life science markets.

PICs4All support SMEs in applying the technology of photonic integrated circuits (PIC) and in more widely using of PICs in many different applications areas. The support consists of assessing the technological and economic feasibility of new products enabled by PICs, the technological conceptualisation and design, the guidance in accessing the right PIC manufacturing technology and the packaging and the testing of integrated photonic devices. The project also aims to stimulate the business of SMEs in new application areas through workshops on the opportunities PICs offer to new product concepts.

LaserGo is a COSME[2] project and is supporting the internationalisation of SMEs outside the EU. When selecting SMEs to be involved in delegation trips, the project also helps in assessing the TRL of the companies' products.

PHABLABs 4.0 is dedicated to implement photonics technologies in Fablabs throughout the EU and one specific service offered by the project to SMEs is the 3D printer in 14 locations.

Photonics4All was dedicated to outreach and has even stimulated the creation of new companies in the photonics field. The "Best Practice Handbook in Photonics Outreach for Entrepreneurs" is available here: **https://zenodo.org/record/473829#.WgAu0HaDOfk**

Services to SMEs provided by the ACTPHAST project (more details in sections 5.8 and 5.9) ACTPHAST is a large scale integrating project of the Framework Programme 7 of the European Commission. Its budget is almost the same as the one of all CSA projects together that have been described earlier. ACTPHAST has been a real success story and ended on October 31, 2017. The new project ACTPHAST 4.0 is bringing the same concept to another level (see 5.9).

The main show-stopper for companies in photonics are related to human resources and expertise (in-house expertise missing, in-house research & innovation too expensive and identification of experts is time-consuming and inefficient) and to technology (in-house cutting-edge technology is missing, investments risk is too high or financially irresponsible and multiple-stop shopping often fails). ACTPHAST is a one-stop shop for supporting EU companies driven by their photonics innovation needs. The project provides at the same time access to most of the best EU experts, to key photonics technology platforms and to innovation support and services that efficiently impact companies. ACTPHAST focuses on pre-competitive photonics product innovation from TRL 4 to TRL 7 with a preference for end-products already close to market.

Technology platforms offered:
a) Free-space optics.
b) Specialty fibres.
c) Polymer-based optics.
d) Micro-Opto-Electro-Mechanical Systems (MOEMS).
e) Photonic Integrated Circuits (PICs) in SiN-SiO, Si and InP.

Keys of ACTPHAST's success:
• Focus on the company's innovation challenge.
• Subsidized innovation lowers company's innovation threshold.
• Centralized contact point quick guidance.
• Single-stop shop top experts and technology.
• Low administrative overhead for company.
• Timely support.

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[2] COSME is the EU programme for the Competitiveness of Enterprises and SMEs, running from 2014 to 2020, with a budget of €2.3billion.

2.2. Whom should you contact?

Service to SME:	Contact Point	Email:
Prototyping Services (Access to technologies)	Brussels Photonics Team (B-Phot), VUB	ndebaes@b-phot.org
Access to infrastructures	Brussels Photonics Team (B-Phot), VUB	ndebaes@b-phot.org
Assessment		michaux@steinbeis-europa.de
Innovation audits	Steinbeis 2i GmbH	michaux@steinbeis-europa.de
Value Chain Analysis	National University of Ireland, Galway	gerard.oconnor@nuigalway.ie
For Photonic Integrated Circuits: Technical and economic viability/Movability to PICs Technology/Value-chain analysis/Conceptualization, Design and Testing	9 PIC Application Support Centres on PICs throughout Europe	Fill in the contact form on: **http://pics4all.jeppix.eu/ documents/register-for-support.html or contact: coordinator@jeppix.eu or ahiguera@tue.nl**
Go2Market:		
Life Science Markets: Medical Technologies, Pharmaceuticals, Agriculture or Food: • Availability of experts (database) • European Photonics Roadshow (B2B meetings with peers, experts and end-users)	Optitec	Fill in the contact form on: **www.pole-optitec.com/fr/ formulaire-de-contact**
Other Markets: • Availability of experts • Access to end-users	Brussels Photonics Team (B-Phot), VUB	ndebaes@b-phot.org
Display your Business Technology offers	Steinbeis 2i GmbH EEN	michaux@steinbeis-europa.de
Internationalisation (outside EU)	Litek	linas.eriksonas@litek.lt
Access to financial and funding instruments	NCPs	michaux@steinbeis-europa.de
European Photonics Venture Forum	Brussels Photonics Team (B-Phot), VUB	ndebaes@b-phot.org
Innovation Power:		
Innovation strategy workshop	Steinbeis 2i GmbH	michaux@steinbeis-europa.de
3D Printer Pilot Fab Labs	Brussels Photonics Team (B-Phot), VUB	ndebaes@b-phot.org
Networking:		
Workshops, Contacts through Clusters and Access to Databases	Photonics21	secretariat@photonics21.org
Outreach	European Centres for Outreach in Photonics	info@ecopalliance.eu lydia.sanmarti@icfo.eu

2.3. Which project can address your needs?

Timeframe

The Gantt chart shows the active periods (months 1–12 across the years 2015–2020) for each CSA/COSME project:

CSA/COSME project	Active period
Photonics4All	2015 (Jan) – 2016 (Dec)
EuroPHo21	2015 (Jan) – 2017 (Nov)
ACTPHAST	Started Nov 1 2013 – 2017
Laser-Go	2016 – 2017
RespiceSME	2016 – 2017
PICs4All	2015 – 2018
EPRISE	2017 – 2019
PHABLABS 4.0	2016 – 2019
NextPho21	2018 – 2020
ACTPHAST 4.0	2017 – 2020 (Ends on Oct 31 2021)
Laser-Go Global	2017 – 2019

Notes:
1. The same colour has been used for projects following each other timewise and having the same basic character.
2. Many of the tools developed in a project already ended are kept available and are usually still used by the photonics clusters or national platforms involved in the project (or even by others).

Target Groups

Legend: **P1** = Priority 1 (red) — covers all actors explicitly mentioned by coordinator as being target group. **P2** = Priority 2 (light red) — Actors that might be (have been) involved but not targets at first.

CSA/COSME project	SMEs	Start-ups	Midcaps	Large Enterprises	(System) Integrators	Device manuf. & Comp vendors	Academics/Scientific	Photonics Experts	End-Users	European Fablabs	Small Children 5-11 yrs	Young Mind/Childrens 10(12)-14 yrs	Students/Teenagers 15-18 (19) yrs	Young Adults 20-24 yrs	Young pro. and technicians 18+	Innovation Hubs	RTOs/Institutes	Entrepreneurs	Regional Photonic Clusters	National Photonics Platforms	Regional authorities	National authorities	Non Photonics Clusters	European Photonics Industry Consortium	General Public
Photonics4All	P1	P1	P2	P2	P1	P1	P1	P1	P1		P1	P1	P1	P1	P1			P1	P1	P1	P2	P2	P2		P1
EuroPho21	P1	P1	P1	P1	P1	P1	P1	P1	P1								P1	P1	P1	P1	P1	P1		P1	P2
Laser-Go	P1				P1	P1	P2		P1									P1	P1	P1	P1	P1	P2		
RespiceSME	P1		P1		P2	P2	P2	P2	P1									P1	P2	P1	P1	P1	P2	P2	
PICs4All	P1	P2	P2	P2	P1	P1	P1		P1									P1	P1	P1			P2	P2	P2
EPRISE	P1	P2	P2		P2	P1	P2	P1	P1									P1	P1	P1	P1				
PHABLABS 4.0		P2					P2	P2	P2	P1		P1	P1	P1	P1	P2		P2	P2	P2					P2

Priority 1
Definiton: Priority 1 covers all actors explicitly mentioned by coordinator as being target group

Priority 2
Definiton: Actors that might be (have been) involved but not targets at first.

Applications addressed

CSA/COSME project	Not especially	Telecoms	Energy	Environment	Transportation	Manufacturing/Industry	LS-Medical technologies	LS-Pharma	LS-Agro	LS-Food	Aerospace	Scientific	Safety/Security	Defence
Photonics4All	X													
EuroPho21	X					X								
Laser-Go						X						X		
RespiceSME			X	X	X	X								
PICs4All		X	X	X	X	X					X	X	X	
EPRISE				X		X	X	X	X	X				
PHABLABS 4.0	X													

Mappings

CSA/COSME project	SMEs in general	SMEs in Biophotonics	SMEs in Photonics for Energy	SMEs in Photonics for Environment	SMEs in Photonics for Transportation	SMEs in Photonics for Manufacturing	Photonic applications in Health	Regions and their S3	Other KET players in the regions	Services for SMEs	Fablabs which adopted Photonics	Applications and Market for PICs	Courses/Education programmes	RTOs
Photonics4All													X	
EuroPho21								X						
Laser-Go		X					X			X				
RespiceSME			X	X	X	X		X		X			X	X
PICs4All	X	X	X	X	X	X						X		
EPRISE		X						X	X	X				
PHABLABS 4.0											X			

Applications addressed

	Photonics4All	EuroPho21	Laser-Go	RespiceSME	PICs4All	EPRISE	PHABLABS 4.0
Countries outside Europe			Primary				
Berlin-Brandenburg	Secondary	Primary			Secondary	Secondary	Secondary
Bade-Wurtenberg	Secondary	Primary		Primary	Secondary		Secondary
Thuringia	Secondary	Primary			Secondary		
Saxony	Secondary	Secondary			Secondary		
Other German	Secondary	Secondary			Secondary		
Stockholm	Secondary	Primary		Primary	Primary	Secondary	
Skåne – Lund/Malmö	Secondary	Primary			Primary	Secondary	
Västra Götaland – Gothenburg	Secondary	Secondary			Secondary		
Other Swedish regions	Secondary	Secondary			Secondary		
PACA - Provence/Alpes/Côtes-d'Azur	Secondary	Secondary			Secondary	Primary	
Bretagne	Secondary	Primary			Secondary		
Île de France - Paris	Secondary	Secondary	Secondary	Primary	Secondary		Secondary
Auvergne – Rhône-Alpes	Secondary	Secondary			Secondary		Secondary
Aquitaine	Secondary	Secondary			Secondary		
Other French regions	Secondary	Secondary			Secondary		
Tuscany	Secondary	Primary			Secondary	Primary	
Lombardy	Secondary	Primary			Secondary	Secondary	Secondary
Piemonte	Secondary	Secondary			Secondary		
Puglia	Secondary	Secondary			Secondary		
Other Italian regions	Secondary	Secondary			Secondary		
Crete		Primary		Primary	Secondary		
Other Greek regions		Secondary			Secondary		
Catalonia		Secondary		Primary	Primary	Primary	
Valencian	Secondary	Secondary			Secondary	Secondary	
Other Spanish regions		Secondary			Secondary	Secondary	
Styria (AT)	Secondary	Primary	Secondary	Primary			Secondary
Other Austrian Regions	Secondary	Primary			Secondary		
Switzerland		Secondary			Secondary		
Wales	Secondary	Primary			Secondary		
Heart of the South West	Secondary	Primary			Secondary		
London	Secondary	Primary		Primary	Secondary		Secondary
Bristol/Bath area	Secondary	Secondary			Secondary		Secondary
Cambridge Shire	Secondary				Secondary		
Hampshire	Secondary				Secondary		
Northampton Shire	Secondary	Secondary			Secondary		
Other UK regions	Secondary	Secondary			Secondary		
Boarder Midland and Western Ireland				Primary	Secondary		Secondary
Eastern FInland		Primary			Secondary	Primary	
Other Finnish regions		Secondary			Secondary	Secondary	
Podkarpackie (PL)					Secondary		
Other Polish regions					Secondary		
Lithuanian regions			Secondary	Primary	Secondary		Secondary
Brussels Capital region					Secondary		Secondary
Flanders					Secondary		Secondary
Wallonia					Secondary		
South Holland	Secondary	Secondary			Secondary		Secondary
North Brabant (NL)	Secondary	Secondary			Secondary	Secondary	
Other Dutch regions					Secondary	Secondary	
Other Danish regions					Secondary		
Slovenia		Primary			Secondary		
Czechian regions					Secondary		
Hungarian regions					Secondary		
South-Western Slovakia (Bratislava)	Secondary				Secondary		
Other Slovakian regions	Secondary				Secondary		
Croatian regions					Secondary		

Legend:

- Primarily: will be/is in contact with representatives of the region (S3) *(dark blue)*
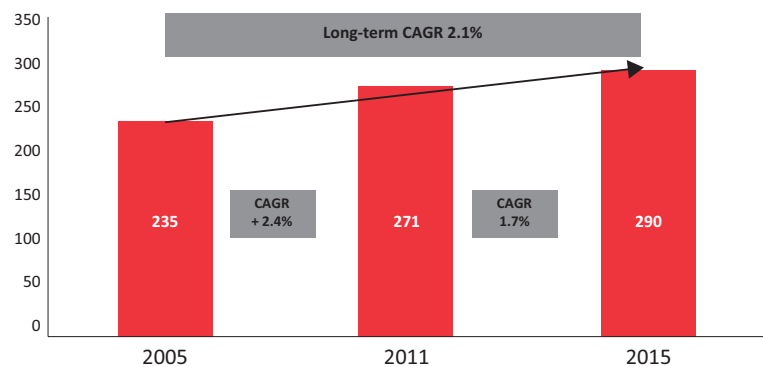- Secondarily/Indirectly: A project partner or action in the region *(light blue)*
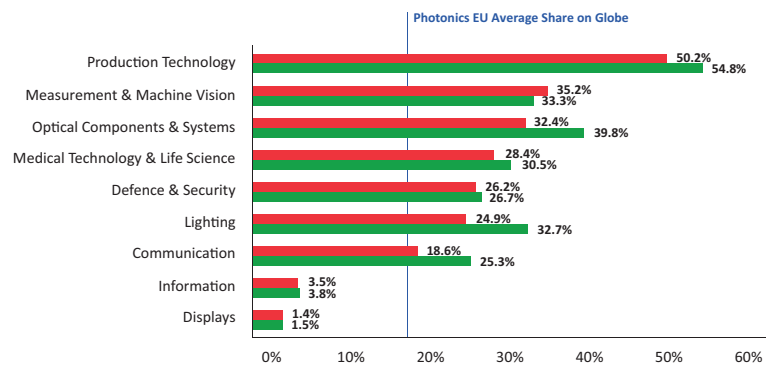- **Regions with Photonics in their S3 priorities** *(red text)*

3. European Photonics Industry in Figures

Growth of the Production Volume of the EU Photonics Industry[1]
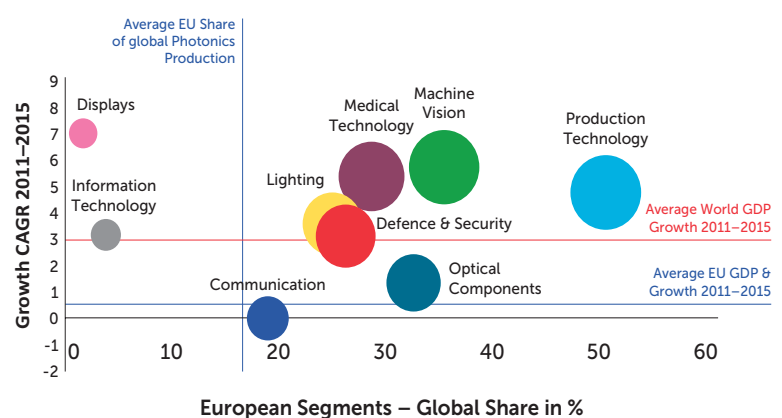The EU Production Global Share was about 18% in 2015

€billion

Long-term CAGR 5.0%
4.6 times more than EU GDP CAGR

2005	2011	2015
41.1	57.3	66.7

CAGR 5.7%   CAGR 3.9%
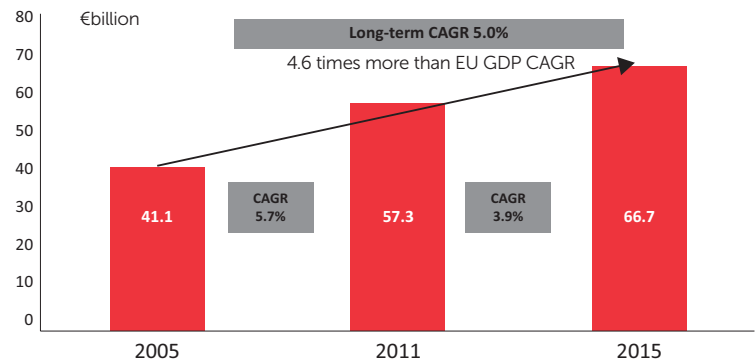
Growth of the Number of Employees in the EU Photonics Industry in thousands[2]

Long-term CAGR 2.1%

2005	2011	2015
235	271	290

CAGR + 2.4%   CAGR 1.7%

Increase of most Global Market Shares of European Photonics Industry from 2011 to 2015[3]

Photonics EU Average Share on Globe

Segment		
Production Technology	50.2%	54.8%
Measurement & Machine Vision	35.2%	33.3%
Optical Components & Systems	32.4%	39.8%
Medical Technology & Life Science	28.4%	30.5%
Defence & Security	26.2%	26.7%
Lighting	24.9%	32.7%
Communication	18.6%	25.3%
Information	3.5%	3.8%
Displays	1.4%	1.5%

Average CAGR of different European Photonics Segments for the period 2011–2015[4]

Average EU Share of global Photonics Production

Growth CAGR 2011–2015

Displays
Information Technology
Lighting
Medical Technology
Machine Vision
Production Technology
Defence & Security
Communication
Optical Components

Average World GDP Growth 2011–2015
Average EU GDP & Growth 2011–2015

European Segments – Global Share in %

4. The Photonics Public-Private Partnership

Milestones

2005: Photonics21 – The European Technology Platform in Photonics was launched.	2009: The EC announced Photonics as one of six Key Enabling Technologies.	2013: Multiannual Strategic Roadmap towards 2020 Creation of the Photonics PPP.	2018: New Strategic Research and Innovation Agenda as a basis for FP9.

Preparing Photonics KET Calls in Horizon 2020[5]

• Experts from all over Europe are identifying priorities and contributing to the preparation of PPP calls.

• During the period 2014-2016 in total 654 participants have taken part in Photonics PPP projects. The total funding of the Photonics PPP projects was 277,969,360,36 €.

Strategy Development

Strategic input based on broad community consultation.

3,000 experts/1,700 companies and research organisations from EU-28 member states.

Strategy Implementation in the frame of Horizon 2020

Photonics KET Calls

European Commission

Open competitive calls applying Horizon 2020 rules and procedures.
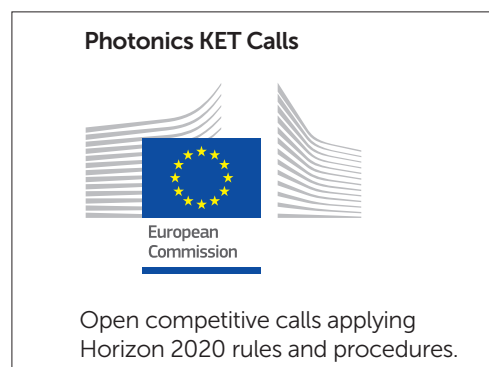
R&D Intensity in the European Photonics Industry – Its involvement in PPP Projects[6]

• R&D intensity in the photonics industry is much higher than in most other industry sectors.

• Photonics industry is leveraging public investment in the PPP projects by a factor of 4.3.

• Photonics industry is today an attractive sector for investments.
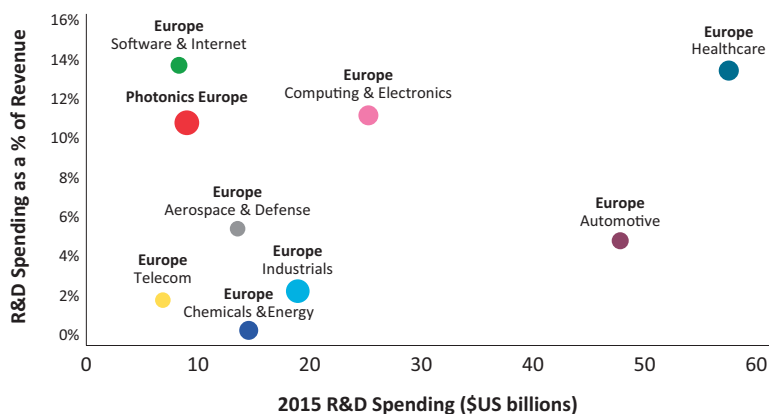
Improving the Innovation Process in Photonics
End-user industry in PPP projects ensures quick market uptake of innovation

Digital Innovation Hubs help end user industry to speed up product development:

PPP Prototyping Services

APPOLO HUB – laser technology assessment expertise in Europe

www.appolohub.eu

Access Center for Photonics Innovation Solutions and Technology Support

www.actphast.eu

Laser equipment ASsessment for High impAct innovation in the manufactuRing European industry

www.lashare.eu

PPP Pilot Lines

Mid-IP Photonics Devices Fabrication for Chemical Sensing and Spectroscopy

www.mirphab.eu

Silicon Nitride Photonic Integrated Circuit Pilot line for Life Science Applications in the Visible Range

www.pixel4life.eu

Shaping the Future in OLED Lighting

www.pi-scale.eu

Photonic Packaging Pilot Line

www.pixapp.eu

5. Description of every project

5.1. EuroPho21

Short Name: EuroPho21
Project Title: **Implementing the European Photonics21 PPP strategy (EuroPho21)**
Duration: January 1, 2015, December 31, 2017.
Website: **www.photonics21.org**

Participant Organisation Name	Country
VDI Technologiezentrum GmbH – European Technology Platform Photonics21 (Secretariat) (VDITZ) (Coordinator)	Germany
AEIT-CORIFI – Photonics National Technology Platform Italy (AEIT)	Italy
Universitat Politecnica de Catalunya – Spanish Photonics Technology Platform (UPC)	Spain
Comité National Optique Photonique – Photonics National Technology Platform France (CNOP)	France
Economic Association Photonics Sweden – Photonics National Technology Platform Sweden (EAPS)	Sweden
Foundation for Research & Technology Hellas – Photonics National Technology Platform Greece (FORTH)	Greece
Joensuu Science Park Ltd. – Photonics National Technology Platform Finland (JSP)	Finland
Knowledge Transfer Network Ltd – Photonics National Technology Platform UK (KTN)	UK
Laser and Health Academy – Photonics National Technology Platform Slovenia Fotonika21 (LHA)	Slovenia
PCO S.A. – Photonics National Technology Platform Poland (PCO)	Poland
Photonics Austria – Photonics National Technology Platform Austria (PA)	Austria
PhotonicsNL Association – Photonics National Technology Platform Netherlands (PNL)	Netherlands
Verein Schweizer Laser und Photonik Netz – Photonics National Technology Platform Switzerland – Swissphotonics (VSLP)	Switzerland

The consortium partners represent 12 National Technology Platforms (NTP) in Europe. These NTPs have been established to mirror the Photonics21 activities in the Member States and provide the link to the regional photonics clusters. The National Technology Platforms and clusters are the strategic link to national and regional policy makers and end user industries and therewith play a critical role in coordinating the PPP implementation. This link will allow a seamless vertical integration and coordination of the photonics activities in Europe – a major roadblock to successfully implement a common photonics strategy in Europe.

Photonics21 and the Photonics PPP have already been described in section 4. Let us summarize here the main contributions of the 12 national technology platforms in photonics in EuroPho21:

• Organisation of regional end user workshops, e.g. "Photonics 4 automotive", "Photonics 4 food industry"or "Light-based solutions for agriculture, veterinary and ecology" sometimes jointly with other CSA projects (EPRISE, RespiceSME, etc.).

• Stimulation of the participation of Member States and regions in the Mirror Group of Photonics21. The national platforms sought synergies between the Horizon 2020 activities and regional smart specialisation strategies to leverage public and private spending for photonics innovation in Europe.

5.2. PICs4All

Short Name: PICs4All
Project Title: **PICs4All: Photonic Integrated Circuits Accessible to Everyone**
Duration: January 1, 2016, December 31, 2018.
Website: **www.pics4all.jeppix.eu**

List of partners:

Short name	Participant Organisation Name	Country
TU/e (Coordinator)	Eindhoven University of Technology	NL
UCAM	University of Cambridge	UK
UPV	Universitat Politècnica de València	ES
PoliMi	Politecnico di Milano	IT
WUT	Warsaw University of Technology	PL
TUB	Technische Universität Berlin	DE
AU	Aarhus University	DK
TPT	Telecom ParisTech	FR
ICCS	National Technical University of Athens	EL
EPIC	European Photonics Industry Consortium	FR
BT	Berenschot	NL

PICs4All guides you through the Photonic IC development value chain
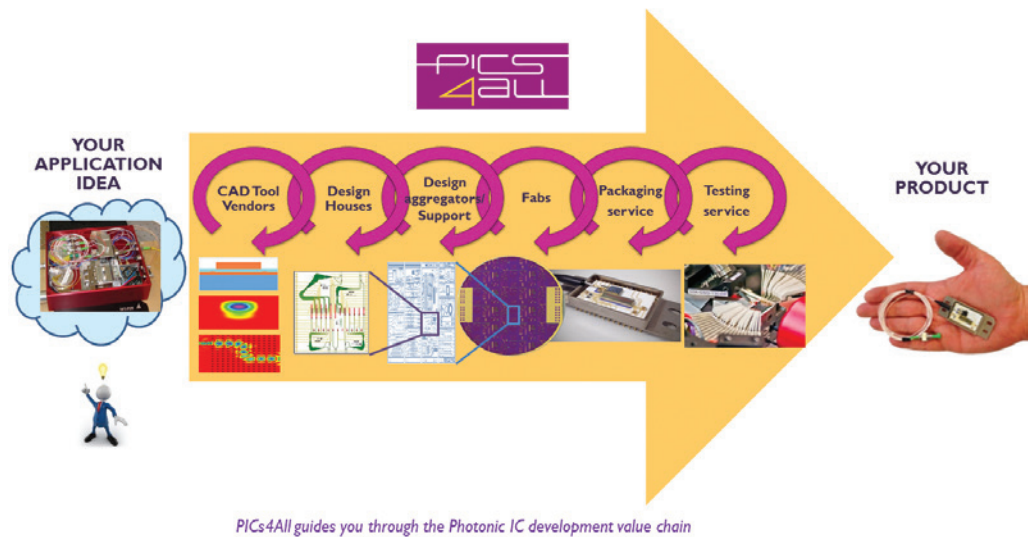
About

Photonic Integrated Circuits (PICs) open up whole new opportunities to create new products and to improve existing electronics and photonic devices. In the H2020 PICS4All project we have formed a European network of experts in Photonic Integrated Circuit (PIC) technology, aiming to bring the PIC technology to a broad audience in Europe.

Actions of PICs4All also aim on bringing together the PIC value chain for Europe's key players in the field of photonic integration, including manufacturing and packaging partners, photonic CAD software partners, R&D labs and PIC design houses. Currently a gap exists between understanding the technology (its capabilities and potential) and market – industrial demands, product specification, product-to-market timelines and technology readiness levels. To enable know-how sharing, the PICs4All has set up a European Network of experts in photonics comprising nine Application Support Centres (ASCs) distributed around Europe. The main task of ASCs is to stimulate the development of novel applications based on PIC-technology, enhance cooperation between universities and other research centres, technology clusters and industry.

Services

The PICs4All experts offer their knowledge and hands-on support to academia, research institutes, SMEs and larger companies to:

• assess whether their ideas or products can be better realized using PICs;

• determine whether the application of PICs is economically viable in their products;

• guide in access to PIC design, manufacturing, packaging and testing services.

Results

The PIC development cycle, as presented in the figure on page 16, is supported entirely by the expertise of PICs4All ASCs. The PICs4All consortium offers free support at every stage of the development cycle of products based on photonic integration technology.

As a measurable result, PICs4All:

• reaches out to hundreds of researchers and companies;

• attains dozens of new leads and users of photonic integration platforms;

• evaluates the impact of the provided support with respect to number of jobs created, and the expected revenue increase (based on customer and industrial partners feedback).
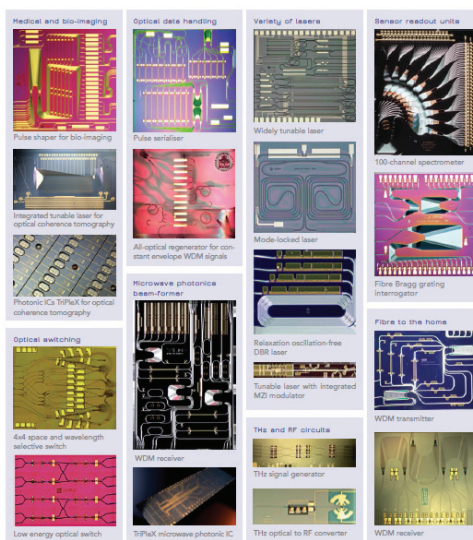
Photonic integration technology enables multiple applications (courtesy JePPIX-TU/e)

5.3. RespiceSME

Acronym: **RespiceSME**
Project Title: RespiceSME − A European project to strengthen Europe's photonics sector
                  by enabling SMEs to enhance and increase their innovation potential
Duration: January 1, 2016 to December 31 2017.
Website: **www.respice-sme.eu**

List of partners:

Short Name	Participant Organisation Name	Country
S2i	STEINBEIS 2I GMBH	Germany
OV	OPTICSVALLEY	France
FORTH	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Greece
OND	OPTECNET DEUTSCHLAND EV	Germany
EaPS	Economic Association PhotonicSweden	Sweden
PhAu	PHOTONICS AUSTRIA	Austria
SECPhO	Southern European Cluster in Photonics & Optics Association	Spain
NUI Gal	NATIONAL UNIVERSITY OF IRELAND, GALWAY	Ireland
LITEK	Lithuanian Laser & Engineering Technologies cluster	Lithuania
KTN	KNOWLEDGE TRANSFER NETWORK LIMITED	United Kingdom

Courtesy of LITEK
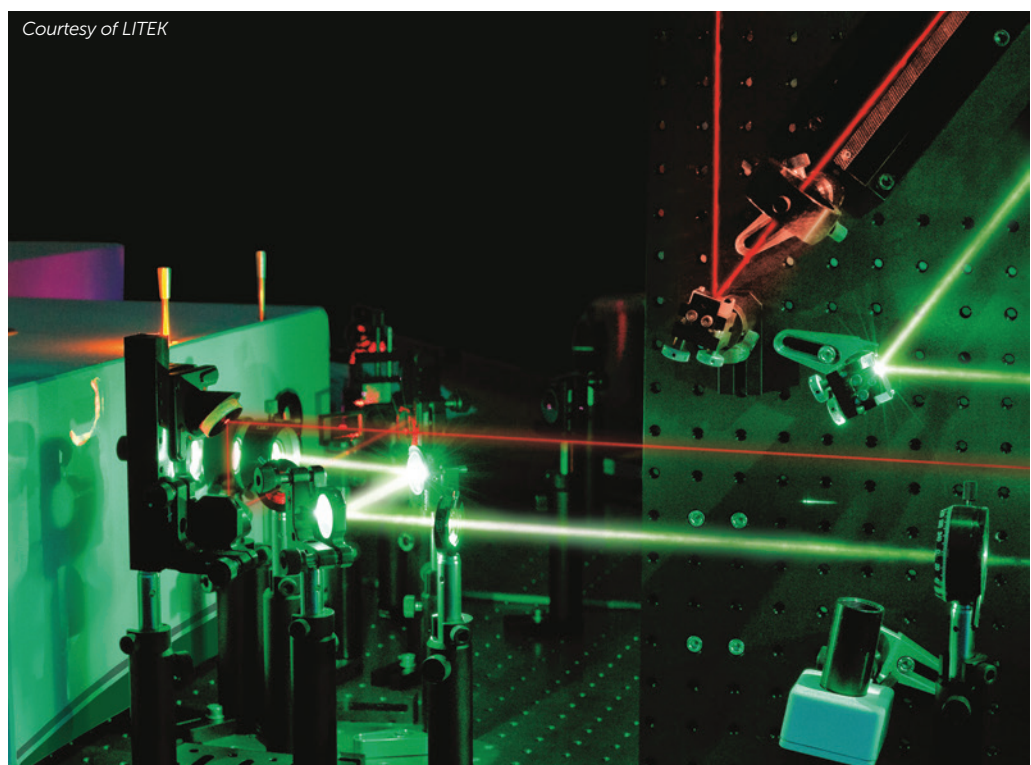
Key Actions

The RespiceSME project's goal is to strengthen the European photonics sector by enhancing the innovative capacity of Europe's photonics Small and Medium Enterprises, clusters and national platforms.

RespiceSME pursues a three dimensional approach to promote photonics innovation. In the first dimension, the RespiceSME priority is on enabling SMEs to evaluate and enhance their own innovation potential by developing instruments and strategies tailored to the SME's needs.

In the second dimension, RespiceSME focuses on the potential of photonics as key enabling technology to leverage non-photonic sectors such as Environment/Energy, Transport, and Manufacturing. RespiceSME project partners thus help high-tech photonics SMEs to explore new business opportunities in these sectors by analysing different value chains.

The third dimension of actions in RespiceSME concentrates on strengthening the competitiveness of the European photonics sector, the major aim being to create a bridge over the 'Valley of Death' for SMEs. The approach applied by RespiceSME is to enhance the innovation support delivered by research, academic education, regional policies and public and private financial instruments.

Results

All tools developed in the project are integrated in a comprehensive toolbox for cluster managers to support their work with SMEs:

RespiceSME developed an Innovation Audit Questionnaire to evaluate the innovation potential of photonics SMEs and helps them to develop a sustainable innovation strategy and define recommendations which lead to an action plan for strengthening their innovation capacity. RespiceSME also helps exploit photonics innovation capacity by analysing different value chains valuable for photonics SMEs and optimises the value of inter-sectoral applications of photonics by promoting better understanding and exploitation of interdisciplinary value chains and sector roadmaps. To support the implementation of the innovation strategy developed, the SMEs need an access to relevant enablers such as RTOs, financial instruments & regional policies (RIS3). A methodology to support SMEs in accessing RTO infrastructures and financial instruments has been elaborated to allow the development of new projects/products/services/business models. At a political level, the partners carried out an analysis of the RIS3 process to show how far regional policy is involved in supporting the innovation potential of SMEs.

Courtesy of LITEK
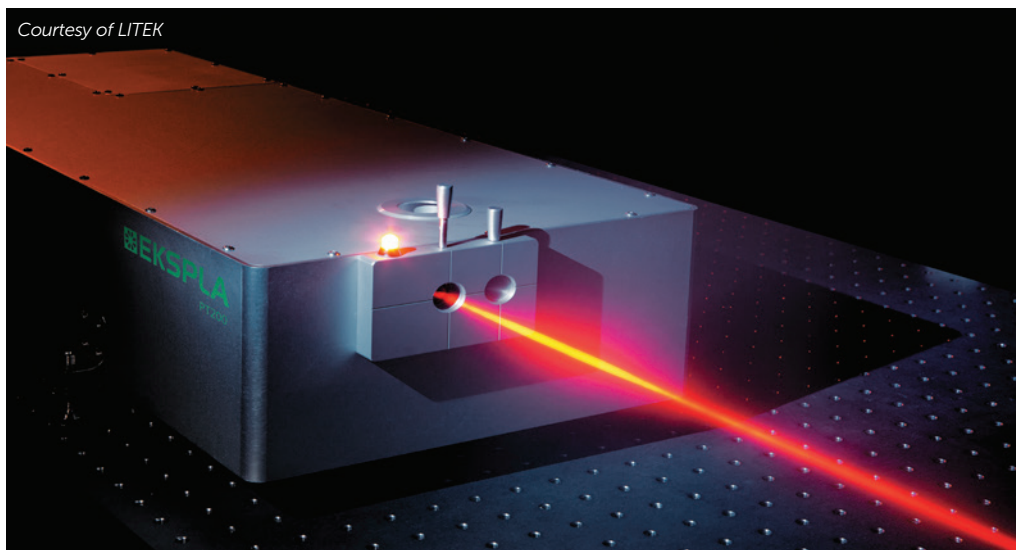
5.4. PHABLABS 4.0

Acronym: PHABLABS 4.0
Project Title: PHotonics enhanced fAB LABS supporting the next revolution in digitalization.
Duration: December 1, 2016 to May 31, 2019.
Website: **www.phablabs.eu**

List of partners:

Short Name	Participant Organisation Name	Country
VUB	Vrije Universiteit Brussel	Belgium
ICFO	Instituto de Ciencias Fotónicas	Spain
FBH	Ferdinand-Braun-Institut, Leibniz-Institut für Hoechstfrequenztechnik im Forschungsverbund Berlin e.V.	Germany
IFN-CNR	Instituto Di Fotonica E Nanotecnologie	Italy
NUIG	National University of Ireland	Ireland
UJM-IOGS	Université Jean Monnet – Institut d'Optique Théorique et Appliquée	France
UoS	University of Southampton	UK
JR	Joanneum Research Forschungsgesellschaft mbh	Austria
S2i	Steinbeis 2i GmbH	Germany
TUD	Delft University of Technology	The Netherlands
FTMC	State research institute Center for Physical Sciences and Technology	Lithuania
FF	FabLab factory (NOLIMEDS)	Belgium
EYESTvzw	Excite Youth for Engineering, Science and Technology	Belgium

Courtesy EYEST

Key Actions

PHABLABS 4.0 aims to integrate photonics in a durable way into the rapidly expanding ecosystem of Fab Labs, resulting in a larger and better skilled photonics workforce with innovation capacity to achieve a lasting, positive impact on the next revolution in digitization. Combining the forces of top experts from 13 European photonics institutes with the Fab Lab stakeholders, PHABLABS 4.0 is delivering 33 Photonics Workshops, 11 Photonics Challenger projects and Photonics Toolkits to enhance Fab Labs with photonics activities aimed at 3 target groups: young minds (age 10–14), students (age 15–18) and young professionals and technicians (age 18+). These activities will be extensively tested in 14 existing Fab Labs with the purpose of rolling them out to the entire growing network of European Fab Labs at the end of the project. They will stimulate hands-on design, experiments, and the building of innovative systems with photonics. The ultimate impact of PHABLABS 4.0 will be seen in the emergence of a much larger and better trained workforce with 21st Century skills capable of translating the potential of photonics as a key enabling technology into products for the benefit of society.

Results and impact

In the PHABLABS 4.0 project we are developing a wide range of attractive photonics workshops and Photonics Challenger projects.

Some examples of the 33 Photonics workshops:

- for young minds (age 10–14): Bat-Style portable torch, 3D picture with lenticular paper, Art with polarization, Laser Labyrinth.

- for the students (age 15–18): IR glove, Gobo slide projector, Pulse detector, Basic Spectrometer, Wi-Fi controlled LED color mixing, Interferometric Laser Kaleidoscope.
- for young professionals (age 18+): Photonics for safer cycling, Photonics Dolpi camera, Photonics Harp, Advanced spectrometer, Photometer with optic and acoustic indicator, Hologram.

During the PHABLABS4.0 project at least 140 photonics workshops will take place in European Fab Labs reaching out to more than 2800 participants.

In addition to the workshops, the PHABLABS4.0 project is running Photonics Challenger Projects for the target groups. Some examples: Lifi in traffic, Greenhouse with photonics, Sound with light, Solar oven, 'Light, love and the Dress', Periscope, Lighting units for holograms.

In May 2018 after the first test phase, detailed instructions of the photonics workshops and the Challengers projects will be freely available at **www.Phablabs.eu**.

Courtesy EYEST

5.5. EPRISE

Acronym: EPRISE
Project Title: Empowering Photonics through Regional Innovation Strategies in Europe
Duration: January 1, 2017 to June 30, 2019.
Website: **https://eprise.eu**

List of partners:

Short Name	Participant Organisation Name	Country
OPTITEC	POLE OPTITEC	France
SECPhO	SOUTHERN EUROPEAN CLUSTER IN PHOTONICS & OPTICS ASSOCIACION	Spain
OpTecBB	OPTEC-BERLIN-BRANDENBURG (OPTECBB) E.V.	Germany
CNR	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy
PNL	VERENIGING PHOTONICSNL	Netherlands
CPI	Centre for Process Innovation Limited	United Kingdom
PhB	PHOTONICS BRETAGNE	France
EaPS	Ekonomiska föreningen PhotonicSweden	Sweden
JTOY	JOENSUUN TIEDEPUISTO OY	Finland

Courtesy of Cobolt AB (part of Hübner) in Stockholm (Sweden)

Key Actions

The EPRISE project is mapping photonics activities and actors in relation to Research and Innovation Smart Specialisation Strategies (RIS3) in the majority of regions of the eight countries covered by the consortium in order to highlight the potential of the local photonics sector to regional policy makers. The project will also identify collaboration and financing opportunities and propose co-funding scenarios for the most promising cases to encourage a combined support of European and regionally managed resources.

Additionally, the EPRISE consortium will organise a "European Photonics Roadshow". Starting from March 2018, a series of 7 major events hosted by European regions will aim to provide SMEs with concrete solutions on how to overcome market barriers via Go-to-market sessions. Target markets are Medical Technologies, Pharmaceuticals, Agriculture and Food. The events also aim to boost collaboration along the complete value chain via pre-arranged B2B meetings.

Project results will be available on the project website in the form of photonics industry & expert database as well as information booklets for the four target markets and a Smart Book on Go2Market session outcomes.

Impact

Project's activities aim at improving the coordination of regional, national and European strategies and resources for the benefit of both local innovation and the European photonics industry. Improved funding synergies and effective coordination between photonics strategies at different levels will result in a less investment-intensive development process for photonics SMEs as well as faster product prototyping and consequently accelerated market access. Moreover, dedicated sessions with experts, taking place during the European Photonics Roadshow, will enhance companies' business skills.

Pre-arranged B2B meetings between companies, integrators and end-users during the project events will foster business development and collaboration along the whole value chain. Additionally, networking with European peers will allow companies to share experiences of accessing the same markets and to join each other's supply chains and/or jointly apply for public funding.

Thanks to the project activities, consortium partners will enlarge the scope and the quality of services for their member companies, including support in accessing funds, qualified advice on access to market and effective business events.

The Consortium of EPRISE; Courtesy of Optitec

5.6. Photonics4All

Acronym: Photonics4All
Project Title: Photonics4All – EU wide outreach for promoting photonics to young people, entrepreneurs and the general public.
Duration: January 1, 2015 to December 31, 2016.
Website: **http://photonics4all.eu**

List of partners:

Short Name	Participant Organisation Name	Country
S2i	STEINBEIS 2I GMBH	Germany
OND	OpTecNet Deutschland	Germany
AIDO	Instituto Tecnológico de Óptica, Color e Imagen	Spain
OV	Opticsvalley	France
EaPS	Economic Association PhotonicSweden	Sweden
PhAu	Photonics Austria	Austria
TUD	Delft University of Technology	Netherlands
UoS	University of Southampton	UK
ILC	International Laser Center	Slovakia
CNR	Institute of Photonics and Nanotechnology of the National Research Council	Italy

Photonics4All Keyvisual; Courtesy of Photonics4All

Key Actions

Photonics4All aimed at promoting photonics to young people, entrepreneurs and the general public throughout the EU. To meet its aims, Photonics4All created a set of promotional tools which were designed, tested and used with target audiences during 230 outreach events throughout the 2-year project (2015–2016).

Tools developed for young people included the development of a short animation video "The Stolen Cup", a Photonics4All App, as well as a brochure listing photonics courses in 7 EU countries. Further actions consisted in organising a photonics board game and a quiz competition, various children's universities including elements of photonics, as well as training physics teachers to use the Photonics Explorer kits developed by EYESTvzw.

Outreach to entrepreneurs included innovation workshops together with guidelines for open innovation in photonics, a European photonics start-up challenge, photonics investment events, boot camps and a brochure about with investment opportunities in photonics.

The general public was reached through light festivals including photonics live demonstrations, the development of a new photonics demonstration kit 'OmniLight Laboratory', promotional bookmarks, expert video interviews and articles, as well as a photonics science slam.

Results

YOUNG PEOPLE: 140,000 children took part in awareness-raising, inspirational events. It is hoped that encouraging these young people to study photonics, through game-based learning and hands-on activities in Children's Universities, will lead to an increase in the number of qualified academics for the engineering/scientific sector. 2,230 physics teachers were trained corresponding to about 111,500 children reached.

ENTREPRENEURS: About 850 photonics professionals were actively involved in our events (including 350 SMEs) and about 10,000 photonics professionals from industry and research were reached in 50 further events (including at least 1,000 SMEs). It is hoped that this engagement will lead to new start-ups and innovative applications in photonics.

GENERAL PUBLIC: More than 200,000 people took part in photonics campaigns with light installations, demonstrations and experiments at which our brochures and 13 different bookmarks were disseminated. An additional 2 million were probably reached through media communications (videos and professional articles).

The most successful Photonics4All tools and activities were described in 3 Best Practice Handbooks produced for all those interested in science outreach and available on our website: **http://photonics4all.eu**.

5.7. LASER-GO

Acronym: LASER-GO
Project Title: Creating and developing the Strategic Cluster Partnership in Photonics for Health
Action Title: COS-CLUSTER-2014-3-03 – Cluster Go International
Duration: January 1, 2016 to June 30, 2017.
List of partners: LITEK (Lithuania)
                 OpticsValley (France)
                 Human Technology Styria (Austria)

Courtesy Science and Technology Park of the Institute of Physics (Všį Fizikos instituto mokslo ir technologijų parkas, FIMTP)

Courtesy Science and Technology Park of the Institute of Physics (Všį Fizikos instituto mokslo ir technologijų parkas, FIMTP)

Key Actions

The overall objective of the project was to setup and develop the cluster partnership aimed at exploring the entrepreneurial opportunities for cluster companies in the targeted markets. The main focus was on the health tech applications where photonics could provide a significant added value in a component, a sub-system or as a final product. The targeted markets included North America, South Africa and Southeast Asia. 6 missions to the target markets and 3 events have been planned during the project. The preparatory work for the missions involved the analysis of the potential of individual cluster companies and the understanding of the market needs in the targeted countries, and matching the companies with the identified needs. In parallel, a partnership building process was initiated to enlarge consortium by bringing in three new partner organisations and adding to the existing three. Finally, the project aimed to establish and follow up the initial contacts with the cluster organisations or other intermediaries in the targeted countries, create linkages and prepare the roadmap for the next stage of the partnership development to be pursued in a follow-up project.

Results

The project took 18 months to complete. First, the reports on partnership capabilities and the targeted markets have been prepared alongside with the Goal Statement and the list of identified 36 technology applications. For the purpose of the capability assessment of the LASER-GO partnership 90 photonics SMEs (30 companies from each cluster) were surveyed. Further, the market analysis was carried to identify high value geographical market segments, high value technology segments and high value product groups. For the potential partner search, a well-structured partner identification and selection method was adopted to select, assess and evaluate the potential partners. This resulted in the enlargement of the partnership by three clusters, one being from photonics and two others from health and health tech clusters. The project concluded with the Partnership Agreement between six clusters (LITEK, OpticsValley, Human.technology, Medicen Paris Region, Biocat and Optence) which have agreed to further develop the European Strategic Cluster Partnership of Photonics for Health resulting in a globally-oriented Network for cluster diplomacy.

5.8. ACTPHAST

Acronym: ACTPHAST
Project Title: Access CenTer for PHotonics innovAtion Solutions and Technology Support
Duration: November 1, 2013 to October 31, 2017
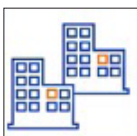Website: **www.actphast.eu**
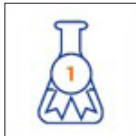
List of partners: Brussels Photonics Team (B-PHOT) of the Vrije Universiteit Brussel, Belgium (coordinator) and 22 other top research institutes all across Europe representing 7 cutting-edge technology platforms covering the broad domain of photonics technologies. See all 23 partners here: **www.actphast.eu/partners**

Key Actions

ACTPHAST is a unique "one-stop-shop" for supporting photonics innovation by European companies, especially SMEs, which is financially supported by the European Commission. ACTPHAST supports and accelerates the innovation capacity of European SMEs by providing them with direct access to the expertise and state-of-the-art facilities of Europe's leading photonics research centres (the ACTPHAST Partners), enabling companies to exploit the tremendous commercial potential of applied photonics.

ACTPHAST has been configured to ensure that companies can avail of timely, cost-effective, and low risk photonics innovation support, and that the extensive range of capabilities within the consortium can impact across a wide range of industrial sectors and application domains. The access to top photonics experts and technology platforms provided by ACTPHAST is realized through focused innovation projects, subsidised by ACTPHAST to reduce the financial risk of innovation for the companies, and executed in short timeframes (7 months on average) with a critical mass of qualified companies with high potential product concepts.

Results

93 innovation projects with companies	Advancement of 2 levels of TRL scale	Average satisfaction level: 4/5
Companies from 18 member states	Average project duration: 7 months	720 new jobs
48% non-photonics companies	31% of the companies are first-time photonics innovators	574M€ new revenues
91% SMEs	R&I expenditure leverage by a factor of almost 2.5	75M€ new venture capital

Brussels Photonics Team (B-PHOT), Vrije Universiteit Brussel (VUB)

5.9. ACTPHAST4.0

Acronym: ACTPHAST4.0
Project Title: ACceleraTing PHotonics innovAtion for SME's: a one STop-shop-incubator
Duration: November 1, 2017 to October 31, 2021
Website: **www.actphast.eu**

List of partners: Brussels Photonics Team (B-PHOT) of the Vrije Universiteit Brussel, Belgium (coordinator) and 24 other top research institutes all across Europe representing 7 cutting-edge technology platforms covering the broad domain of photonics technologies. See all 25 partners here: **www.actphast.eu/partners**

ACTPHAST4.0, the Photonics Innovation Incubator for SMEs in Europe, builds on the existing momentum created by ACTPHAST, leveraging the already established well-oiled network of photonics competence centers across Europe using fully proven processes, templates and systems for engaging with SMEs, executing collaborative innovation projects and measuring their impact. In building on what is already in place, ACTPHAST4.0 is elevating SME innovation support to a whole new level of excellence by:

- adding new competences and capabilities to extend and deepen the photonics technology supply chain;
- adding new value-added support services to companies in the form of business, technology and financial coaching;
- delivering innovation support on an even broader scale with more projects with more SMEs made up of more non-photonics end-user industries, first timers and early adopters, representing more European regions;
- making it even faster, leaner and more user-friendly for SMEs;
- developing linkages with the EU pilot lines in photonics for further scaling of innovation projects out of ACTPHAST4.0 towards mass manufacturing;

- exploring and disseminating best practices for co-funding models with European regions for further increased leverage on photonics innovation and sustainability of impact on the digitization of European industry;
- achieving even greater impact on European business, entrepreneurship and jobs growth.

The new industrial paradigm – Industry 4.0 – entails the digitisation of all aspects of economic and societal activity in applications from Smart Cities, Factories of the Future and the Internet of Things, to Autonomous Vehicles, CleanTech and Digital Health. Photonics, through technologies such as optical fibres, optical lenses, machine vision, sensors, lasers, energy efficient LEDs, etc. is a key enabling technology that is critical to achieving this future.

ACTPHAST 4.0 offers wonderful new opportunities to boost photonics innovation in Europe at a scale and with a leveraging factor never seen before, accelerating the deployment of existing proven photonics technologies by all sorts of "first-user" companies in all sorts of new products, thereby acting as a game-changer in revitalizing European manufacturing and one of the vital catalysts to the successful digitisation of European industry.

5.10. New Projects (started in January 2018)

NextPho21

Partners: VDI Technologiezentrum GmbH (coordinator), same partners as for EuroPho21 (see 5.1) but with Ireland's National Technology Platform for Photonics and without Fotonika21 (Slovenia).

Duration: 2018–2020.

Website: **www.photonics21.org**

NextPho21 provides the decisive support to the European Photonics21 community for developing a European industrial strategy for the upcoming 10 years. Strategy development will involve more than 3000 Photonics21 and end-industry experts in an open, transparent and democratic decision-making process. The strategy approach focusses on future market opportunities arising from the megatrends like digitisation, urbanisation, smart anything everywhere which disrupt business models and whole industries. Through developing the joint strategy, the European photonics industry will be in the pole position to become a key driver of this revolution. Furthermore, NextPho21 will set up a management and steering platform for implementing the current Horizon2020 Photonics21 Public Private Partnership strategy. It provides strategic and organizational support to the PPP boards and Horizon2020 Photonics KET (PPP) projects in reaching its objectives, namely to create

growth and jobs in Europe. This includes a central public relation and dissemination services to the projects demonstrating the impact of photonics for wider deployment of photonics in end user industry products. NextPho21 implements a dedicated set of actions to increase the investments in photonics research, development and manufacturing by European venture capital funds and the European Investment Bank to bring photonics innovation to the market. It will trigger cross regional and cross member state strategy development and investments in photonics respectively by providing a coordination and support platforms to these stakeholder groups. The NextPho21 project consisting of the Photonics21 secretariat and 12 National Technology Platforms – representing more than 25 photonics clusters – runs at the request, with the consent and on behalf of the Photonics21 PPP Boards which will closely steer all activities of the project.

LASER-GO GLOBAL – Global Development of the European Strategic Partnership in Photonics for Health (continuation project of Laser-Go, see 5.7)

Partners: LITEK (LT), coordinator; OpticsValley (FR), Human.technology (AT), MEDICEN (FR), Biocat (ES), Optence (DE).

Duration: Jan 2018 – July 2019.

The project aims to further develop the European Strategic Cluster Partnership in Photonics for Health into a Global Value Network bringing together six clusters from 5 EU countries from the healthcare, health tech and photonics sectors and the business networks and intermediary organisations from eight advanced and/or fast-growing economies. The meta-cluster (having access to some 1600 SMEs and 100 RTOs from six regional hotspots and entrepreneurial regions in the emerging sectors) will setup through the global network of clusters and their counterparts in the target markets the Global Value Network through which cluster company offers will be realized as business cases at a scale to monetize the value

streams from company products, services, knowledge or information. The project aims to develop Value Mapping Analysis tools (intelligence about the unmet market needs in the target markets, creation of a network of technology scouts and of network representatives from the local photonics and health tech ecosystems). A systematic analysis of the value streams of the SMEs involved and match-making their value propositions with those of the companies in the target markets will create joint business cases attractive for investors and markets. The project will organize the network building activities (innovation missions and events in the target markets) to facilitate the transfer of cluster knowledge and learning.

www.photonics21.org