

Jobs and Growth in Europe – Realizing the Potential of Photonics

An abstract graphic consisting of several overlapping, rounded, organic shapes in various colors: dark blue, light blue, green, yellow, red, and pink. A central, light beige shape contains the text 'PPP Impact Report 2017'.

PPP Impact
Report 2017



PHOTONICS PUBLIC PRIVATE PARTNERSHIP

Jobs and Growth in Europe – Realizing the Potential of Photonics

PPP Impact Report 2017

Jobs and Growth in Europe –
Realizing the Potential of Photonics
PPP Impact Report 2017

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Foreword

In December 2013, we established the Photonics Public-Private Partnership (PPP) to build on the strengths of the European Photonics sector and to reinforce its competitiveness through a long-term commitment to a shared vision. In this partnership, the European Commission, the photonics industry, and the R&D community have joined forces – we collaborated in a growing and ever stronger Photonics PPP, we have developed strategic Horizon 2020 work programmes and we have raised awareness of photonics as a Key Enabling Technology for the European industry. More than 3000 members of the European Photonics21 Platform, coming from more than 1700 organizations all over Europe, are part of this endeavour.

This joint effort is necessary, as Europe has set itself an ambitious target of uplifting its digital innovation capacity and ensuring that any industry in Europe of any size and any sector can take full benefit of the digital transformation of the economy. Photonics has a fundamental capacity to transform industrial processes and products as well as potential to lead to breakthrough innovations in many different application areas ranging from manufacturing, ICT, lighting & energy to healthcare, security and environmental protection. The Photonics PPP has been launched to make the difference and speed up the innovation process in those areas where Photonics can have a significant impact – not only economically, but also where it contributes to overcoming important societal challenges.

The efforts have paid off: The photonics sector is important in itself; with a global market of €447Bn in 2015 the sector is growing twice as fast as the global GDP. Seen on a European level photonics outgrows GDP by even 3.5 times. Europe is the second largest producer of photonics products behind China with around 300,000 people employed directly in the photonics sector. In many Photonics areas, we are leading the world, including production technology, optical components and systems, and measurement and automated vision. In these areas Europe holds more than one-third of the world market.

To maintain this level and to consolidate the global position of the European Photonics industry, we want to make the entire European innovation ecosystem more efficient. First Photonics PPP test labs and pilot production services now are being made accessible to all SMEs in Europe to spur new competitive products and accelerate time to market, helping them to reap the benefits of photonics in terms of jobs and growth. Currently intensive discussions with national and regional authorities are taking place to link up all these activities and make them sustainable. We want to create digital photonics innovation hubs that will give SMEs access to latest technologies to become more competitive, more advanced and more successful on a global scale.

Finally, the Photonics PPP is addressing the issue of innovation and growth financing beyond Horizon 2020. New risk taking financing instruments are urgently needed by innovative companies. Too often promising companies fail in Europe due to the lack of financing. The Photonics PPP is cooperating with the European Investment Bank and other actors to address this problem. The “European Photonics Venture Forum” supported by the PPP is one tangible example of supporting photonics start-ups in Europe.

Photonics is playing and will continue to play an important role in Europe, by shaping and enabling the digitization of industry, in order to provide a competitive edge to European companies and to their products. This report gives you an overview of the impact of the Photonics PPP activities conducted during the last years.



Aldo Kamper
Photonics21 President
CEO Osram Opto Semiconductor



Khalil Rouhana
Deputy Director-General of DG CONNECT
European Commission

Photonics Public-Private Partnership at Glance

Investment

Nearly **€10Bn** – In 2015 European Photonics Industry pledged €9.6Bn to Innovation (R&D spending and Capex)

R&D intensity in the Photonics industry amounts to nearly **10%**

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

Industry participation in Horizon 2020 PPP projects increased to **45%** compared to 35% in FP7

7 Prototyping and Pilot Manufacturing services to help end user industry to speed up product development

€49M invested by the EC in the PPP Pilot manufacturing services (Pilot lines)

67 Projects started so far under the frame of Horizon 2020 with a public investment of a total of **€278M** EC funding over the first 3 years of Horizon 2020: 2014-2016.

Market

The European Photonics market amounts to **€69Bn** per annum

European Photonics Production has increased by over 62% over the last 10 years

The European Photonics Production has grown with an average CAGR of **5%** since 2005

European Photonics Production Growth rate is more than **3.5** higher than EU GDP Growth rate

50% global market share for European Photonics for Production Technology

35% global market share for European Photonics for Optical Measurement & Image Processing

32% global market share for European Photonics for Optical Components and Systems

People

19,000 new jobs created in the European Photonics Industry

Forecast: **42,000** new jobs could be created by 2020

9 PPP Projects explicitly devoted to promoting Research, Education & Training in Photonics

More than **1700** Photonics companies and research organisations back the Photonics PPP.

More than **3000** registered personal members in the platform Photonics21

About **1000** attendees in Photonics PPP strategy development workshops and meetings



Application areas of Photonics: Digitisation is made possible because of high-speed optical transmission systems; Eco-friendly Lighting Systems using semiconductors and LED; Analysis of the building blocks of life using fluorescence spectroscopy; Optimising surgical techniques using accurate and minimally invasive imaging systems; Laser becoming an universal tool in Manufacturing; Additive manufacturing processes becoming an integral part of tomorrow’s smart manufacturing industry; Optimising man/machine and/or machine/machine interaction as well as machine control, autonomous driving in the smart city is thriving because of photonics sensing systems.

Sources: from left to right and from above to below: iStock.com/Maxiphoto; iStock.com/JoeChristensen; © drimafilm – Fotolia.com; © s4svisuals – Fotolia.com; © kange_one – Fotolia.com; © fotofabrika – Fotolia.com; © zapp2photo – Fotolia.com; © folienfeuer – Fotolia.com

Introduction: Looking back at the Establishment of the Photonics Public-Private Partnership (PPP)

“Photonics is the science of the harnessing of light. Photonics encompasses the generation of light, the detection of light, the management of light through guidance, manipulation, and amplification, and most importantly, its utilisation for the benefit of mankind.”
Pierre Aigrain, 1967.¹

“The 21st century will depend as much on photonics as the 20th century depended on electronics”
UNESCO, IYL 2015

Photonics has undergone a phenomenal and exciting development over the last 50 years. No longer a theory or a laboratory experiment, Photonics technologies have become a part of the everyday life, with so many different new applications and innovative products far beyond obvious lighting applications. Today, the global market for photonics applications amounts for €447Bn and has nearly doubled alone in the last 10 years.² It has become a highly competitive market and the world’s biggest corporate giants go to considerable efforts to reap the rewards of photonics technologies.

Photonics is everywhere around us and underpins many different technologies of everyday life from smartphones, cutting edge healthcare diagnosis tools, efficient lighting systems, to the fundamental technologies for the Factories of the Future. In order to raise global awareness of the “problem-solving potential of light technology”, the UNESCO proclaimed 2015 as the International Year of Light and Light-based Technologies (IYL 2015)³. IYL 2015 was endorsed by several international scientific unions, e.g. the International Council for Science, the International Commission for Optics or the International Social Science Council and brought together hundreds national and international partners with the aim “to raise awareness of the importance of light science and technology in areas such as sustainable development, energy, education, climate-change, and health”⁴. IYL 2015 had a huge impact: more than 13.000 events of various kinds (scientific conferences, exhibitions, activities at schools, etc.) took place, involving / reaching 147 countries. Against the background of IYL 2015, the European Commission provided €2.85M for Coordination and Support Actions in 30 European countries to promote the importance of light science and careers in photonics to young people, entrepreneurs, and the general public. The IYL 2015 are committed to further promote initiatives in the future – one of those being the European Photonics Platform Photonics21.⁵

¹ http://cordis.europa.eu/fp7/ict/photonics/home_en.html, last accessed on 2017/03/01.

² Global Photonics Industry grew from €228Bn in 2005 to €447Bn in 2015.
Source: Optech Consulting Market Research Study 24.1.2017.

³ www.light2015.org/Home.html, last accessed on 2017/03/20.

⁴ UNESCO (2016): The International Year of Light and Light-based Technologies 2015 – A successful Community Partnership for Global Outreach – Final Report. Available under: www.light2015.org/Home/About/IYL-Final-Report.html, last accessed on 2017/03/20. P. vii.

⁵ UNESCO (2016): The International Year of Light and Light-based Technologies 2015 – A successful Community Partnership for Global Outreach – Final Report. Available under: www.light2015.org/Home/About/IYL-Final-Report.html, last accessed on 2017/03/20.

⁶ UNESCO, 2015 International Year of Light.

⁷ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, “Preparing for our future: Developing a common strategy for key enabling technologies in the EU” (SEC(2009) 1257).

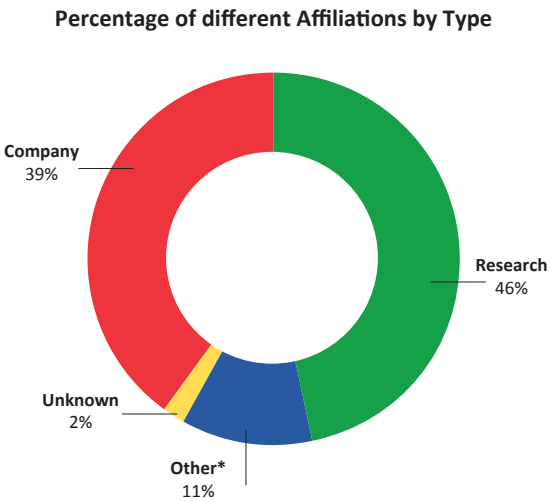
In order for the European Photonics Industry to explore the future applications of light and to reap the expected benefits of creating jobs and wealth, joint European initiatives between industry, the scientific community and policymakers are required.

Photonics21 – the European Technology Platform on Photonics

The Photonics21 European Technology Platform was launched in 2005 with the aim to be the first European programme to bring together stakeholders from industry, academia, and policy in photonics. Since its establishment, the platform has grown and today includes about 1700 organisations with more than 3000 members.

The Photonics21 membership shows that two fifths of the affiliations are companies – nearly the best possible share of companies in an innovation platform. The Photonics21 Board of Stakeholders (BoS), the decision-making body of the Platform Photonics21, consists of 100 representatives of leading photonics organisations in Europe – half of which come from industry. The structure of Photonics21 provides an optimal balance between research and innovation promoting activities.

Fig. 1: Analysis of Affiliations of Photonics21 Membership (Data: 2016).
Source: VDI TZ GmbH.



*Others include e.g. Associations, Politicians & Governmental Organisations Clustermanagers, National Platforms, Consultants, Journalists

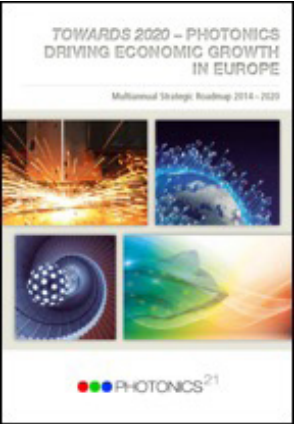
Photonics as Key Enabling Technology

In 2009, the European Commission announced photonics as one of six Key Enabling Technologies for Europe’s future prosperity⁷. In doing so, the EC did not only acknowledge the economic importance of Photonics, but also recognised the key role it plays for a wide range of technologies and applications. The European Commission underlined the potential this Key Enabling Technology may offer for coping with a number of societal challenges of our time. These included *ensuring sustainable development, increasing energy efficiency, addressing the needs of an ageing population, and ensuring human and environmental health*. Finally, the role Photonics could play in achieving secure employment across Europe – now and in the future – was recognised.

Introduction: Looking back at the Establishment of the Photonics Public-Private Partnership (PPP)

Photonics21 – Creating a Common European Photonics Agenda

Over the period 2007–2013, Photonics21 coordinated two strategy processes involving the whole European Photonics community and focussed on promoting Photonics research in Europe. This lead to two strategic reports: the strategic research agenda “Lighting the way ahead”⁸ (published in 2010) and the Multiannual Strategic Roadmap “Towards 2020 – Photonics driving economic growth in Europe”⁹ (published in 2013). Both reports have played an important role in securing substantial support for Photonics R&D under the 7th Framework Programme for Research of the European Commission (EC) (2007–2013) and Horizon 2020 (2014–2020). Only in FP7, 129 Photonics R&D projects – including those funded under the topic Advanced Thin, Organic and Large Area Electronics (TOLAE) technologies – were supported with a total EC funding of €461M.



Towards 2020 – Photonics driving Economic Growth in Europe. Published by: European Technology Platform Photonics21, Brussels, April 2013.



Official handover to Neelie Kroes, former Commissioner for the Digital Agenda by the Photonics21 Executive Board at the Annual Meeting 2013. Source: Photonics21/VDI Technologiezentrum GmbH, Photograph: Vivian Hertz.

The current Multiannual Strategic Roadmap 2014–2020 is the result of extensive discussions in the Photonics21 Work Groups involving more than 300 experts from the European Photonics Community. It built on the recommendations of the KET Initiative, proposing to set up a Photonics Public-Private Partnership in Horizon 2020. The goal of this setup was “for achieving the critical mass necessary for developing a coherent application oriented and market needs driven technology & innovation, and for strengthening [R&D and innovation] capabilities across the full value chain”¹⁰.

A Public-Private Partnership to promote European Photonics

Against increasing global competition in Photonics as well as of systemic weaknesses of the innovation process within photonics in Europe¹¹, the creation of a Public-Private Partnership (PPP) for European Photonics was initiated by Neely Kroes, then European Commissioner for Digital Agenda, in 2013.

The Aims of the PPP are to:

- “Foster photonics manufacturing, job and wealth creation in Europe through a long term investment commitment by both industry and the European Commission;
- Accelerate Europe’s innovation process and time to market by addressing the full innovation and value chain in a number of market sectors where European photonics industry is particularly strong (e.g. lighting, medical photonics, and optical components & systems);
- Mobilise, pool, and leverage public and private resources to provide successful solutions for some of the major societal challenges facing Europe, in particular in healthcare & well-being, and energy efficiency.”¹²

⁸ European Technology Platform Photonics21 c/o VDI Technologiezentrum, coordinating editors VDI Technologiezentrum: Flaig, Katharina; Wilkens, Markus (2010): Lighting the Way ahead, Strategic Research Agenda in Photonics, Düsseldorf. Available under: www.photonics21.org/download/SRA_2010.pdf, last accessed on 2017/03/15.

⁹ European Technology Platform Photonics21 c/o VDI Technologiezentrum (2013): Towards 2020 – Photonics Driving Economic Growth in Europe (Multiannual Strategic Roadmap 2014–2020), Brussel. Available under: www.photonics21.org/download/Brochures/Photonics_Roadmap_final_lowres.pdf, last accessed on 2017/03/15.

¹⁰ European Technology Platform Photonics21 c/o VDI Technologiezentrum (2013): Towards 2020 – Photonics Driving Economic Growth in Europe (Multiannual Strategic Roadmap 2014–2020), Brussels, Available under: www.photonics21.org/download/Brochures/Photonics_Roadmap_final_lowres.pdf, last accessed on 2017/03/15. p. 6.

¹¹ For more information, see the analysis conducted by the EC in the frame of the Key Enabling Technologies (KET) initiative of Strengths, Weaknesses, Opportunities and Threats of the European Photonics: https://ec.europa.eu/growth/industry/key-enabling-technologies/challenges_en, last accessed on 2017/03/16.

¹² European Technology Platform Photonics21 (2013): A Photonics Private Public Partnership in Horizon 2020, Brussels, Available under: www.photonics21.org/download/Photonics21_Association/A_Photonics_Private_Public_Partnership_Photonics_PPP_proposal_final-final.pdf, last accessed on 2017/03/16. p. 18.

Introduction: Looking back at the Establishment of the Photonics Public-Private Partnership (PPP)

Policy and industry pulling together to boost Photonics R&D investment in Europe

The Photonics PPP represents a long-term commitment between the European Commission and the Photonics Stakeholders to invest in Europe with the aim of securing Europe’s industrial leadership and economic growth in photonics, a highly skilled workforce, and the capability to generate new jobs attractive to young people. Never before had the European Industry and European Policy worked so closely together in such an important technology domain.

Acknowledging the importance of this Public-Private Partnership for fostering Photonics in Europe, the European Photonics Industry committed itself to significantly increase the level of private funding allocated to R&D in Photonics. In particular, it made a pledge to **match every Euro spent by the European Commission in the PPP with four Euro spent by Industry**. The European Photonics industry also promised to support SMEs and young workers through the creation of new jobs.

The PPP is the basis for a common Research and Innovation strategy and for an industrial strategy in photonics for Europe throughout 2014-2020. On a regular basis, stakeholders from industry, the science community and policy are coming together in workshops, as well as on PPP Annual Meetings to develop future research priorities in photonics.

Following the recommendations of the Multiannual Strategic Roadmap 2014–2020 by Photonics21, a set of Key Performance Indicators (KPIs) has been defined to monitor and assess the implementation and the socio-economic impact of the Photonics PPP. These Key Performance Indicators have been monitored over the last years and provide the data for this first PPP Impact Report.

Photonics21 Vice Presidents Bernd Schulte and Giorgio Anania and EU Commission Vice President Neelie Kroes (from left to right) officially signed the Photonics PPP contract in the frame of a Signing Ceremony for the eight contractual PPPs under Horizon 2020 in Brussels 2013. Source: Photonics21/VDI Technologiezentrum GmbH, Photographer: Bea Uhart.



Commissioner Günther H. Oettinger opened the plenary session of the Annual Meeting 2016 with his keynote speech “Photonics for the successful digitization of European Industry”. Source: Photonics21/VDI Technologiezentrum GmbH, Photographer: Vivian Hertz.



With the Photonics PPP, an important instrument has been created allowing all members of the Photonics community in Europe to come together to boost Photonics innovations. Photonics will impact most areas of our lives in the near future. Photonics will enable the development of future internet infrastructures with unprecedented capacity and will lead to new IT services and business models. At the same time, photonics will enable a significant reduction in energy consumption by ICT systems. New manufacturing processes will be developed to improve quality and reduce resource consumption while enabling mass customization. Photonics will permit less invasive healthcare treatments and surgical methods. Photonics may even revolutionize healthcare by moving away from treating diseases to preventing them with highly sophisticated diagnostics tools. Because of photonics, new intelligent and low-energy lighting systems will be realised. Photonic sensing and imaging will allow new pollution detection methods, providing us with a greener environment, as well as new surveillance technologies increasing safety and security in everyday life.

However, the exciting forecast by many within the industry is that Photonics as a Key Enabling Technology may lead the *digitization of industry*, which can considerably “impact on factors that shape a nation’s future economic and competitive edge”, according to Michael Mertin, former Photonics21 President at the annual PPP Meeting in 2016.¹³

The Photonics PPP is the best place for all Photonics stakeholders in Europe to keep up to date with the latest developments.

¹³ www.photonics21.org/download/Annual_Meeting/AnnualMeeting2016/Photoncis21_PressRelease-2016AnnualPPPevent_C1_final.pdf. Last accessed on: 2017/03/02.

I. The Photonics Public-Private Partnership – Leveraging Investment in Europe

I.1. EC Funding & Implementation of the Photonics PPP

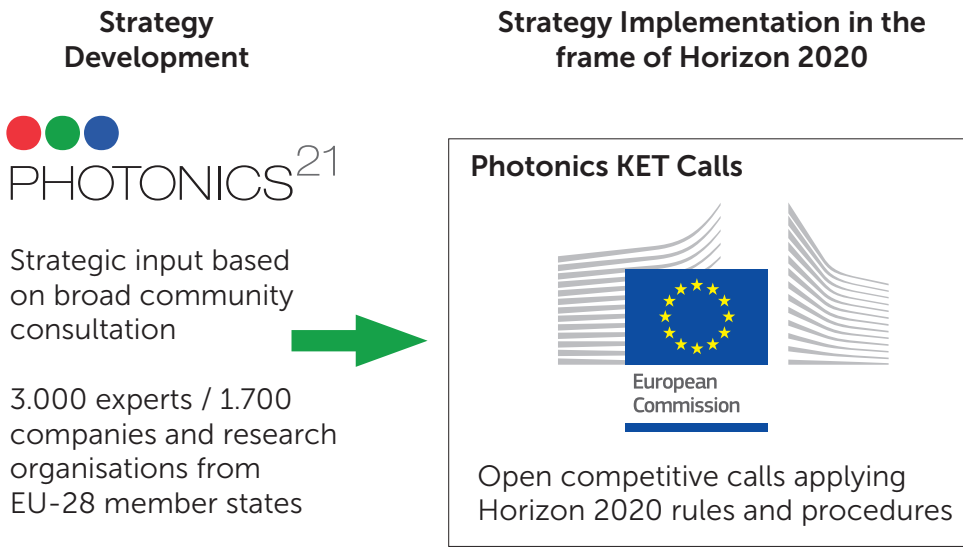
Photonics21 provides strategic input based on broad community consultation

Against the background of the goals as presented in the Multiannual Strategic Roadmap, the Photonics21 platform involves the European Photonics community in the definition of potential research priorities for European Photonics. These issues, developed in close consultation with the Photonics21 work groups, and prioritized by the Photonics21 Board of Stakeholders, reflect the needs of the European Photonics industry. They provide a valuable input to the EC to be used in its research funding policy and policy implementation.

Implementation of research priorities in the frame of Horizon 2020

Based on the recommendations of the Photonics21 platform, the European Commission defines Photonics research priorities and implements in the scope of Photonics PPP KET Calls in Horizon 2020. These Calls are open competitive calls, applying the application and selection rules and procedures of Horizon 2020, the Photonics PPP KET Calls are not just open to Photonics21 members but everyone is welcome to apply.

Fig. 2: Development and Implementation of Photonics KET Calls in Horizon 2020: respective roles of Photonics21 and the EC. Source: VDI TZ GmbH.



Up to this point in time, the EC has funded 67 Photonics PPP Projects under the frame of Horizon 2020 to the tune of approximately €380M. An analysis of the tenderers and proposals submitted, carried out by the EC during 2014, underlines that almost half of the projects funded are coordinated by non-Photonics21 members.

Fig. 3: Openness indicators of Photonics PPP Calls in Horizon 2020: Analysis of Photonics21 membership and impact on Horizon 2020 projects accepted/rejected by the European Commission. (Year: 2014) Source: European Commission, DG CONNECT.

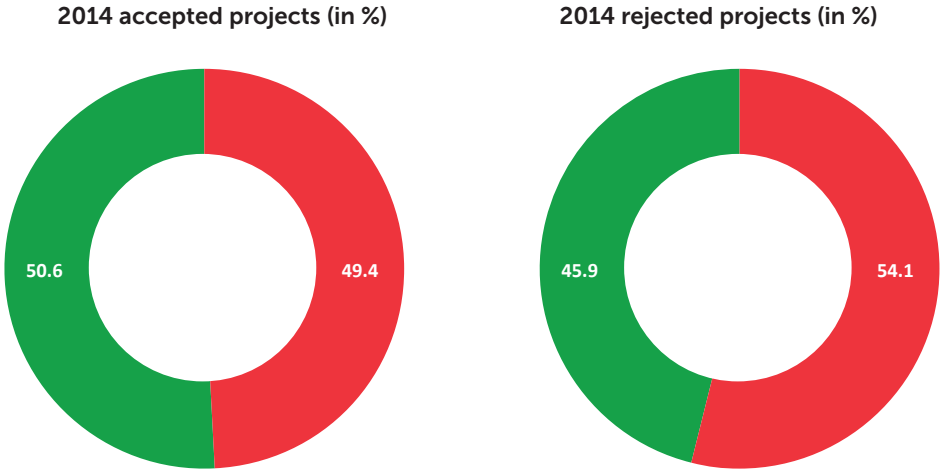
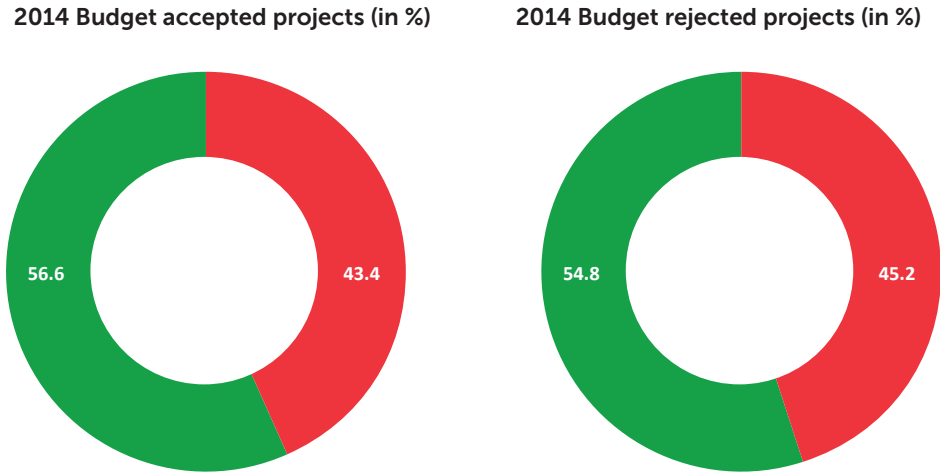


Fig. 4: Openness indicators of Photonics PPP Calls in Horizon 2020: Analysis of Photonics21 membership and impact on Horizon 2020 budgets for projects accepted/rejected by the European Commission. (Year: 2014) Source: European Commission, DG CONNECT.



An overview of all PPP Projects started so far, as well as the brief description of their objectives, can be found under the following link on the website of the Photonics21 Platform: www.photonics21.org/ppp-projects. This list is regularly updated, so as to provide up-to-date information on current and newly started PPP Projects.

I. The Photonics Public-Private Partnership – Leveraging Investment in Europe

I.2. R&D Intensity in the European Photonics industry

One aim of the Photonics PPP was to increase R&D Spending in Photonics. The measures taken have been so efficient that increased investments in Photonics R&D in Europe were made.

Nearly €10Bn industry investments on Photonics Innovation in Europe in 2015

In total, the European Photonics Industry showed Innovation Spending (R&D spending and Capex) in Europe in 2015 to be around €9.6Bn – comprised of €6.4Bn for R&D spending and €3.1Bn for Investment (Capex).¹⁴

R&D intensity in the Photonics industry amounts to nearly 10%

On average, European Photonics companies spent 9.7% of their revenues for R&D in 2015. They invested on average 4.7% of their revenues (Capex / sales) bringing the total R&D and investment quota to 13.8%.¹⁵

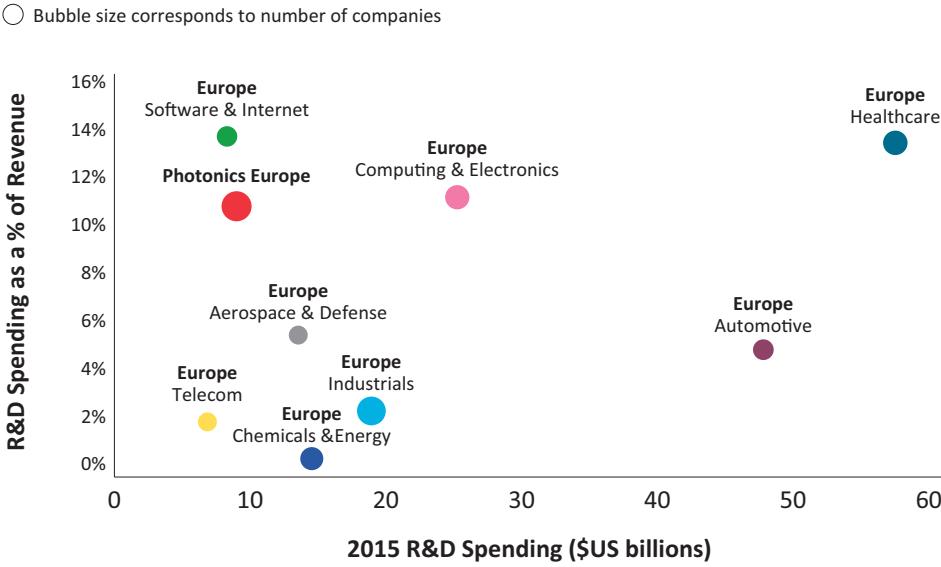
Of course, the R&D intensity does vary, depending on the Photonics segment as well as on single companies. For instance, R&D intensity at ASML, the largest Photonics producing company in Europe, is very high, amounting to 17.7%. The R&D intensity is comparably high in the communication sector (e.g. 17.7% for Adva Optical and 16.6% for Alcatel Lucent). The situation is similar when considering the Capex / sales ratio, which is particularly high for companies “operating in product segments requiring costly manufacturing equipment and facilities”.¹⁶

The R&D intensity of companies in the Photonics sector may vary from 3% to 18% and the Capex / sales ratio ranges from 2% to 11%.

R&D intensity in the Photonics industry much higher than in most other industry sectors

The European Photonics Industry is devoting much more funding to R&D than many other industry sectors: compare the figure of 9.7% of revenues spent by the European Photonics Industry for R&D to the average industrial R&D intensity in Europe of about 3.2%.¹⁷ Comparing by industry sectors, it appears that the R&D intensity in the European Photonics industry is much higher than in most other industry sectors – even more than Aerospace & Defence, Automotive, Industrial, and Chemicals & Energy sectors.¹⁸

Fig. 5: Comparison of R&D Spending in Photonics vs. other Industry Segments in Europe in 2015. Source: VDI TZ GmbH, based on the data by PwC: www.strategyand.pwc.com/innovation1000#VisualTabs3.



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

One of the aims of the Photonics PPP is to provide an incentive for companies of the Photonics sectors to increase the budget they devote to Photonics R&D. Today, this impact report of the PPP shows that the promise has been honoured: European industry and EU policy have joined forces to increase R&D investments and photonics industry has leveraged public investment in the PPP projects by a factor of 4.3.

¹⁴ Optech Consulting Market Research Study 24.1.2017.

¹⁵ Optech Consulting Market Research Study 24.1.2017.

¹⁶ Optech Consulting Market Research Study 24.1.2017, S. 85.

¹⁷ Cf. The 2016 EU Industrial R&D Investment Scoreboard.

¹⁸ Cf. PwC, The 2016 Global Innovation 1000 Study: Comparison of R&D Spending by Regions and Industries, PriceWaterhouse & Coopers. www.strategyand.pwc.com/innovation1000#VisualTabs3, last accessed on 2017/02/22.

I. The Photonics Public-Private Partnership – Leveraging Investment in Europe

“Combined with other smart technologies, [Photonics] has led to exciting innovations addressing bankable economic challenges”¹⁹

George Ugras, chairman of the 2016 Inpho Venture Summit²⁰

Increasing industrial R&D spending and investment hit the headlines

The Photonics industry is today an attractive sector for investment – by companies already active in this sector and wanting to consolidate their position or by external investors seeking to profit from the potential offered.

Over the last few years, industrial R&D spending and industrial investment in Photonics have made headlines: Plessey Semiconductors Ltd., for instance, announced in 2015 an £60M expansion of its LED manufacturing facility;²¹ in 2015, the Hutchinson Group – one of the UK and Ireland’s biggest laser engineering firms – announced the creation of 80 new jobs as part of a £4.1M (€5.5M) investment.²² Last year, the science and technology company Merck KGaA opened a new production plant for OLED materials;²³ Indigo Diabetes, a new Belgian startup, won investment capital amounting to €7M for developing an optical glucose monitoring chip;²⁴ Trumpf, the world’s largest industrial laser company set up a €40M venture fund;²⁵ the holographic display developer Holoxica won €1.3M to develop next-generation 3D medical displays²⁶ – to name but a few. Investments made in the photonics sector aim at addressing a wide range of potential applications, from displays to laser applications or to applications in the healthcare sector.

¹⁹ www.inpho-ventures.com/images/docs/press2016/Inpho-EN-160427.pdf

²⁰ The Inpho Venture Summit is a biennial financial investor and strategic business partnering event focusing on potential growth markets as well as on technologies potentially shaping our future. www.inpho-ventures.com/

²¹ www.photonics.com/Article.aspx?AID=57690&PID=6&VID=124&IID=839, last accessed on 2017/03/16.

²² <http://optics.org/news/6/12/31>, last accessed on 2017/03/16.

²³ www.photonics.com/Article.aspx?AID=61102&PID=6&VID=134&IID=909, last accessed on 2017/03/16.

²⁴ <http://optics.org/news/7/12/30>, last accessed on 2017/03/16.

²⁵ <http://optics.org/news/7/9/13>, last accessed on 2017/03/16.

²⁶ <http://optics.org/news/7/2/16>, last accessed on 2017/03/16.

I.3. Industry involvement in PPP projects

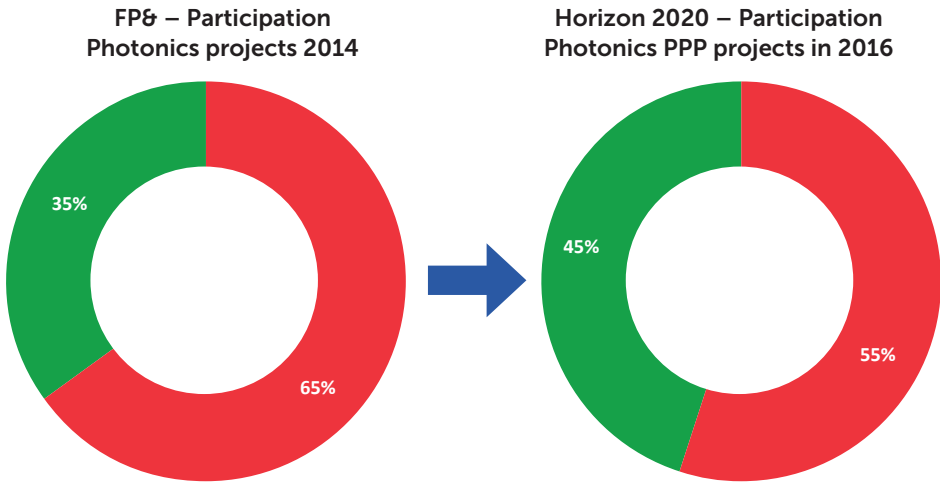
The Photonics PPP has led to a strong increase of the industry participation in EU-funded Photonics R&D projects.

Significantly higher industry involvement in PPP Projects than in former funding frameworks

In fact, the PPP can point to considerable achievements: today, about 45% of the consortium partners of Photonics R&D projects under Horizon 2020 are industries – compared to 35% in Photonics R&D projects under the framework of FP7.

Fig. 6: Industry Participation in Photonics projects in FP7 & Horizon 2020. The Photonics PPP is on a good track to reach the Horizon 2020 aim of increasing industry participation to at least 50%, which is the optimal share of industry participation and which ensures balancing the interests of Industry and Science community. Source: VDI TZ GmbH.

● RTOs
● Industry



I. The Photonics Public-Private Partnership – Leveraging Investment in Europe

I.4: Improving the innovation process in Photonics

End user industry involvement in PPP projects ensures quick market uptake of innovation

One of the strengths of the European Photonics industry lies in having global market leaders in several core industrial segments as well as in already established links with application industries – this was one of the findings of the SWOT-analysis of the European Photonics industry, as conducted by the EC a few years ago.

The Photonics PPP aimed to build on this strength and promote the involvement of end-user industries in the PPP projects. A number of PPP projects either directly involve end-user industry such as Health Tech companies (see e. g. the projects DiCoMo, CardiS, INNODERM) or are directly driven by end-users requirements in the various potential sectors of application. For example, in the manufacturing sector, the project ultraSURFACE aims at developing sophisticated optical concepts for more efficient laser structuring, laser polishing or laser thin-film processing applications. The project HIPERDIAS is driven by end-user requirements and aims at demonstrating highthroughput laser-based manufacturing – for a wide range of applications but focussing on 3D structuring of silicon at high speed, precision processing of diamond material and fine cutting of metal for the watch and the medical industry. Another example of the involvement of end-user industry is the project SEERS aiming at developing a modular, compact and cost effective snapshot spectral imaging system to be demonstrated in coastal and road tunnel surveillance and involving AIRBUS Defence & Space.

These projects are only a small number of examples for end-user involvement in the PPP Projects. They all promise a quicker implementation of new photonics innovations into marketable products and promise to overcome one of the former weaknesses of the European Photonics industry, (as identified by the EC a few years ago), the time-to-market of innovations being considered too long.²⁷

Digital Innovation Hubs: PPP Prototyping and Pilot Manufacturing services help end user industry to speed up product development

Under the framework of the Photonics PPP, 4 Pilot Lines have been created. These Pilot Lines give European Photonics companies the opportunity to test and validate their ideas and new products before entering into the marketplace. For SMEs, which do not often have the financial resources and the infrastructure needed to bridge the gap to develop, test and manufacture new products on their own, the PPP Pilot Lines offer a very valuable support.

²⁷ For more information, see the analysis conducted by the EC in the frame of the Key Enabling Technologies (KET) initiative of Strengths, Weaknesses, Opportunities and Threats of the European Photonics: https://ec.europa.eu/growth/industry/key-enabling-technologies/challenges_en, last accessed on 2017/03/16.

“With these Pilot Lines Europe will position itself at the forefront of innovation in photonics. Our companies, and in particular the manufacturing sector, will have access to support for innovation and the facilities needed to get ahead in global markets. Photonics is a crucial component for the successful digitalisation of European industry and the economy”
Günther H. Oettinger
in his function
as European
Commissioner for
Digital Economy and
Society, February
2016.

The 4 PPP Pilot Lines cover very different application domains, ranging from health applications (PPP Project PIX4Life), flexible organic light-emitting diodes (PPP Project PI-SCALE), sensors for the detection of chemicals in gas and liquids (PPP Project MIRPHAB to Photonics Integrated Circuits (newly started PPP Project PIXAPP). The EC has invested €49M in these Pilot Lines to speed up the development process boosting the competitiveness of European Photonics industry. Up to now, the 4 Pilot Lines have reached companies in 15 countries.

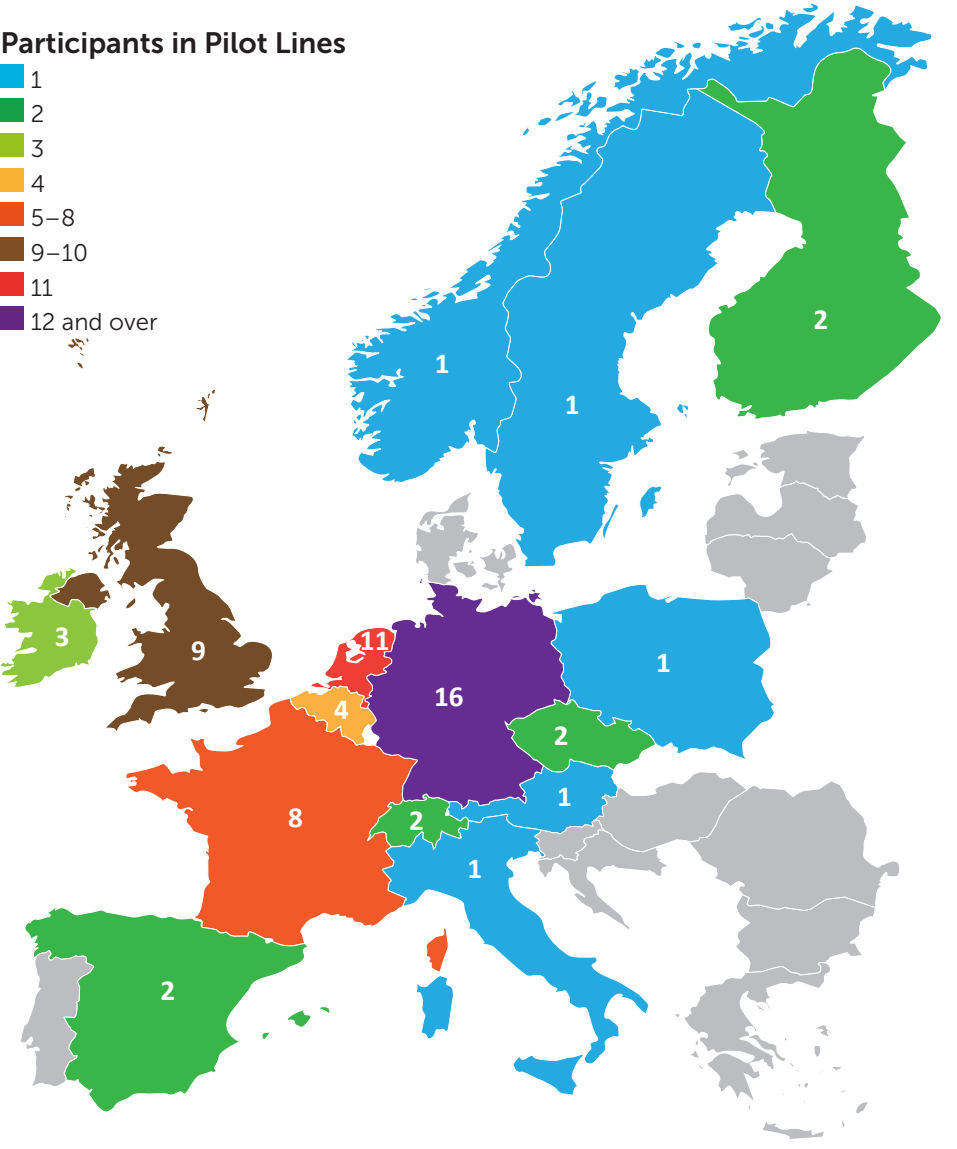


Fig. 7: Geographical distribution of the beneficiaries of the Pilot Lines MIRPHAB, PI-SCALE, PIX4LIFE and PIXAPP. The beneficiaries of the pilot lines are spread all over Europe with a focus on Germany, the Netherlands, the UK and France. Source: VDI TZ GmbH. Data provided by EC-DG CONNECT.

I. The Photonics Public-Private Partnership – Leveraging Investment in Europe

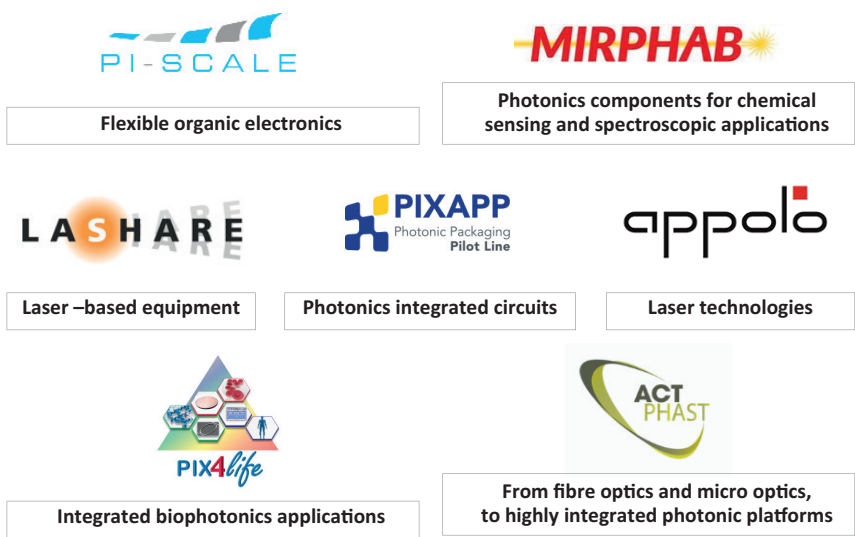
In addition to these 4 Pilot Lines, 3 PPP Projects provide prototyping services to companies, namely ACTPHAST supporting firms in designing and prototyping photonic solutions, LASHARE helping companies to test laser based equipment in production environments and APPOLO which aims at supporting companies (especially SMEs) in validating laser technologies for (micro)fabrication, e.g. in the automotive sector or in printing/decoration industries.

Both the Pilot Lines and the prototyping services aim to help end user industries to speed up product development, and provide useful support in optimizing the innovation processes in the European Photonics industry.

Statistics collected by ACTPHAST to measure its impact on European innovation are quite impressive: ACTPHAST is currently supporting companies (over 90% are SMEs of different sizes) with photonics innovation across 15 different European member states and succeeds in reaching companies that had not been supported under the frame of /previous EU innovation funding mechanisms. Nearly 60% of companies have no previous experience in EU-funded innovation projects.

ACTPHAST reaches companies beyond the Photonics sector: more than 40% of the companies supported are “non-photonic companies” of various sectors (e.g. healthcare, transport, consumer goods, industrial manufacturing, etc.). With the support of ACTPHAST, more than 30% of the companies supported are able to conduct an innovation process in photonics for the first time. The following figure makes the potential socio-economic impact of support mechanisms as provided by ACTPHAST tangible: over the next five years, nearly 500 new EU jobs are expected to be created by companies that are benefitting from support by ACTPHAST as a direct consequence of their ACTPHAST innovation projects.²⁸

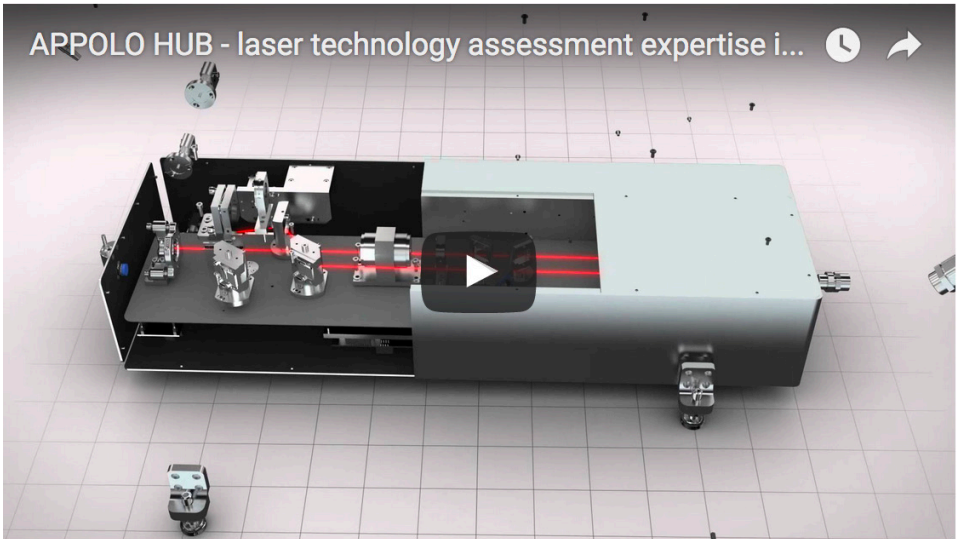
Fig. 8: Bridging the gap between lab and fab: 4 PPP Pilot Lines and 3 PPP Prototyping Services help end user industry to speed up product development. Source: VDI TZ GmbH.



²⁸ www.actphast.eu/support-statistics, last accessed on 2017/03/16.

Video 1: APPOLO HUB – laser technology assessment expertise in Europe

Link: www.appolo-fp7.eu/index.php?page=1 / www.youtube.com/watch?v=Q_Za-atlYLg



Video 2: ACTPHAST - photonics innovation accelerator for European companies

Link: www.youtube.com/watch?v=pP2yYDxwtHU



I. The Photonics Public-Private Partnership – Leveraging Investment in Europe

I.5. Financing Photonics Innovation beyond Horizon 2020

Photonics PPP Task Force Financing in cooperation with EIB

Against the background that European Photonics Industry (as most of the KET industries) – despite of outstanding growth and innovation potential – are often lacking access to capital, a Photonics PPP Task Force Financing was created in close cooperation with the European Investment Bank (EIB) in order to facilitate a better understanding of available instruments as well as to establish a concrete action plan on how the photonics industrial community – in particular high-potential, high-growth SMEs – can be better served with financial investments beyond the H2020 grants.

In fact, according to an analysis carried out by the PPP Task Force Financing, it can be assumed that there are up to 500 innovation and growth oriented photonics companies in Europe with combined financing needs for business development amounting to €1–10Bn. At the same time, photonics and photonics-like companies appear to be massively underserved by the VC sector – the European photonics sector getting only about 1-2% of the estimated overall VC capital/year. Furthermore, as analysed by the PPP Task Force Financing, most instruments of the InnovFin joint initiative of the EIB and the European Commission fail to reach the smaller photonics companies in Europe – exactly those who might particularly need support in financing innovation.

Therefore, the Photonics PPP Task Force started to

- analyze the demand side needs, in particular establish a good understanding on the needs for financial investment by Photonics SMEs and Early on Investment Stage companies;
- match those needs with the Supply side offers, as well as
- organize relevant workshops and events for bringing the necessary actors together.

Photonics PPP is supporting various initiatives seeking Private Equity for Photonics Industry

Responding to the needs of the European Photonics Industry, the platform Photonics21 is supporting several European events and initiatives seeking private equity for seed phase and entrepreneurs:

- The inpho conferences (formerly “Invest in Photonics”) conferences biyearly held in Bordeaux, which have been the first EU conferences focused exclusively on photonics – and with focus on innovative SMEs.
- The European Photonics Venture Forum (EPVF), bringing photonics entrepreneurs looking for external private capital together with investors, which was first held in 2015 in Rome and second in Eindhoven in June 2016. Aims of this Forum are to raise awareness about the Photonics Market within the investor community, to support the Photonics Industry in raising funds as well as to ensure photonics becoming a pillar of regional development. The next edition of the EPVF that will take place in Dublin in Mai 2017 is being co-organized by the PPP Pilot Line ACTPHAST.
- Boot Camps for young Entrepreneurs organized in the frame of the PPP Project Photonics4all and aiming, for instance, at preparing future Photonics entrepreneurs for negotiations with investors.

Video 3: European Photonics Venture Forum Eindhoven 2016

Link: www.youtube.com/watch?v=HLEG4um-BTc



II. Jobs and Growth – Economic Impact of the Photonics PPP

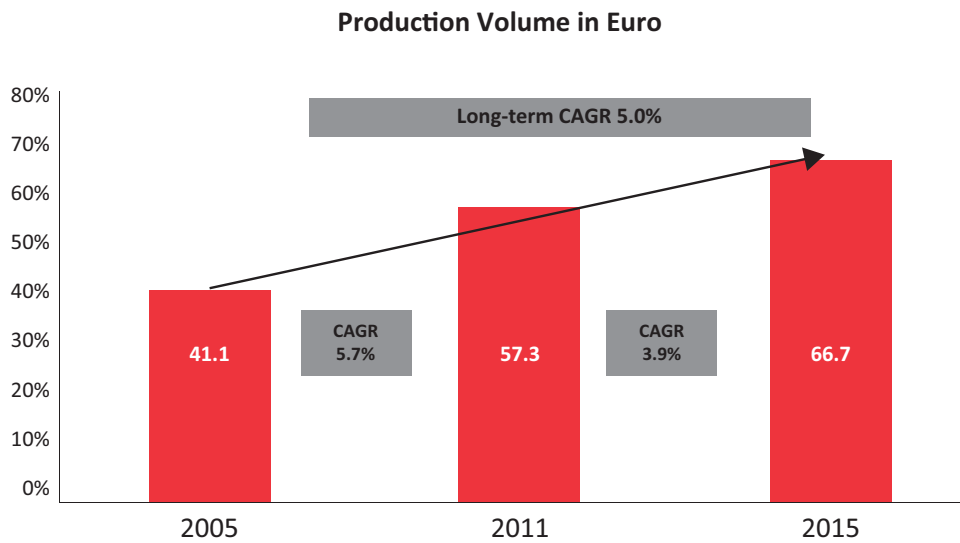
The Photonics PPP addresses all photonics segments, from production technology, medical technology & life sciences to lighting, displays and defence & security. Only Photovoltaics is not covered by the PPP, as Photovoltaics R&D is being supported in the energy area of Horizon 2020. Assessing the impact of the Photonics PPP does therefore mean concentrating on development and performance of the European Photonics Industry without the Photovoltaics segment. All Data used in this report therefore exclude the Photovoltaics segment.

II. 1 Ensuring Growth and Competitiveness of the European Photonics industry

About 62% growth in the last 10 years

The European Photonics Production accounted for €66.7Bn in 2015 – compared to €41.1Bn in 2005. This represents an overall growth of about 62% over this period and an average CAGR of 5%. However, the growth rate had not been constant over that time, decreasing from 5.7% from 2005–2011 to 3.9% from 2011 to 2015. The slowdown of the growth rate of the Photonics industry in the period 2011–2015 is primarily due to currency effects and the devaluation of the Euro vs the US dollar, as well as to increasing competition from China in the global Photonics production and an overall less favourable economic conjuncture in Europe in the period 2011–2015.²⁹

Fig. 9: Growth of the Production Volume of the EU Photonics Industry. The EU Photonics production demonstrated a solid long-term growth rate of 5% p.a. in the period 2005–2015. Source: Optech Consulting Market Research Study 24/01/2017.

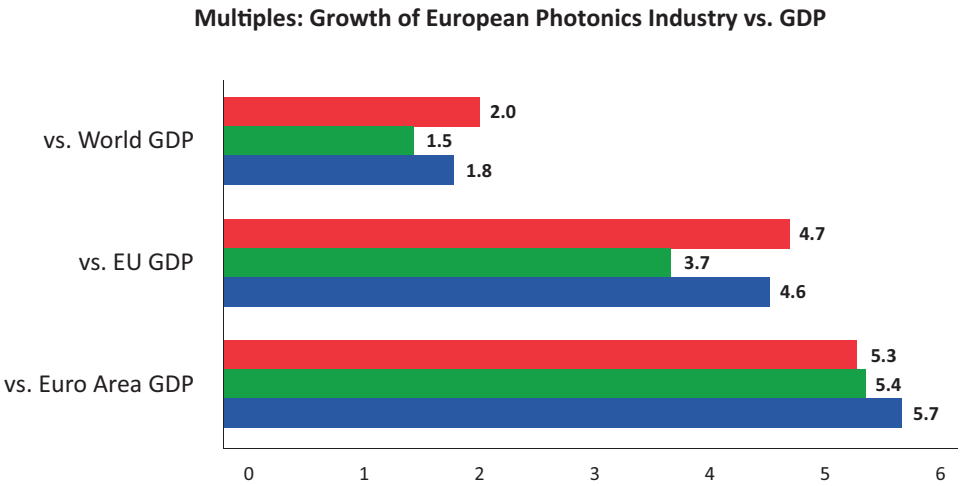


²⁹ Optech Consulting Market Research Study 24.1.2017.

European Photonics Production Growth rate more than 3.5 higher than EU GDP Growth rate

The European Photonics Production grew much stronger than industrial production in Europe in general, which nearly stagnated in the EU28 in the period 2011–2015 with a CAGR of only 0.1%.³⁰ The growth rate of the European Photonics industry has been also higher than the growth rates of EU GDP (3.7 times multiple growth rate) or global GDP (1.5 times multiple growth rate) in that period. Looking into the long-term performance from 2005–2015 EU Photonics industry was able to demonstrate about twice of the average long-term global GDP growth of 2.8%.

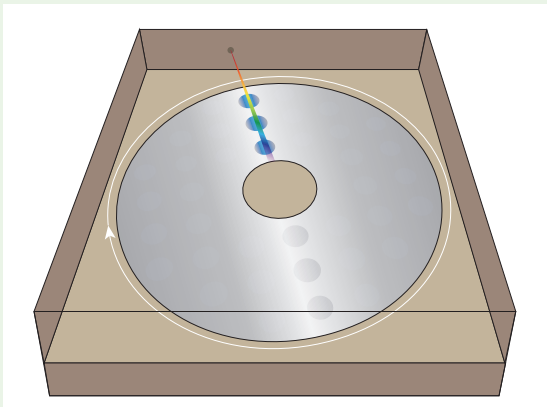
Fig. 10: Multiples: Growth of European Photonics Industry vs. GDP. The EU Photonics industry was able to outgrow GDP levels in the period 2005–2015. Reflecting the fact that EU GDP and Euro Area GDP grew more slowly than World GDP in that period, the multiples growth rates are quite lower when referring to global levels. However, the European Photonics Industry grew stronger than GDP, even in the period 2011–2015 when having faced strong competition from China, as well as suffered from the strong devaluation of the Euro compared to the US dollar. Source: Optech Consulting Market Research Study 24/01/2017.



- Multiples 2005–2011
- Multiples 2011–2015
- Multiples 2005–2015

Success story

Cobiophad – rapid allergy detector to beat penicillin deaths



Sufferers of hypersensitivity to common antibiotics like penicillin and amoxicillin will soon find help with a new allergy detector, a low-cost, bio-photonic device that will be 6 times faster and 100 times more efficient than current technology, providing more targeted treatment for millions of patients. **More**

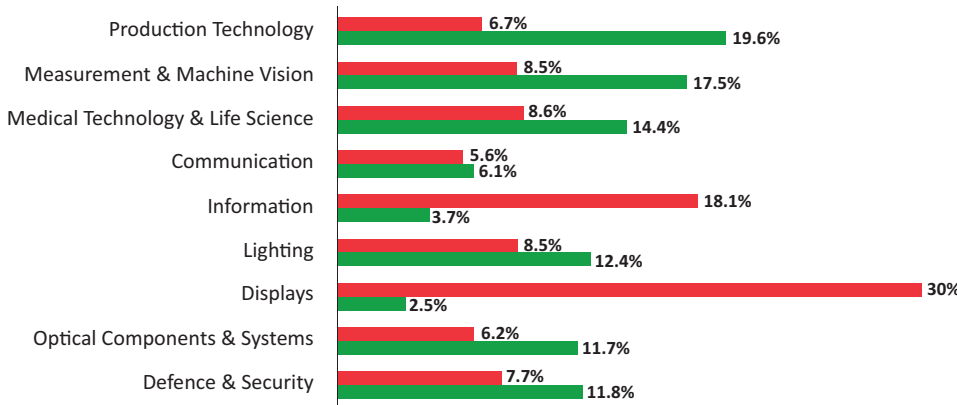
II. Jobs and Growth – Economic Impact of the Photonics PPP

European Photonics industry has an outstanding focus on global market

The regional specialization in the various photonics segments remained intact and became even more pronounced in the last years. The focus of the European Photonics industry is strongly different from the focus of the global Photonics industry: the segments Production Technology, Measurement & Machine Vision, Medical Technology & Life Science as well as Lighting make up for the largest portion of European photonic market. The segments Displays, Information and Communication are clearly focused in Asia, while they do not play an important role in Europe.

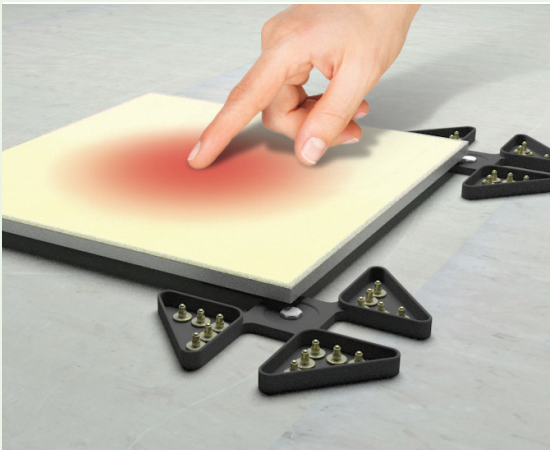
Fig. 11: Focus of the Global vs. European Photonics Industry. Production and Industrial Segments, Optical Components and Medical Technology play a more pronounced role in Europe. Source: Optech Consulting Market Research Study 24/01/2017.

- World
- Europe



Success story

Lumentile – digital wallpaper means end for painting and decorating



Redecorating your living room could be as easy as pressing a button thanks to European scientists who have created a new ceramic tile that can change colour, pattern, or play videos with one tap of your finger, radically changing the way we interact with buildings or public spaces, and taking us a step closer to instant camouflage. [More](#)

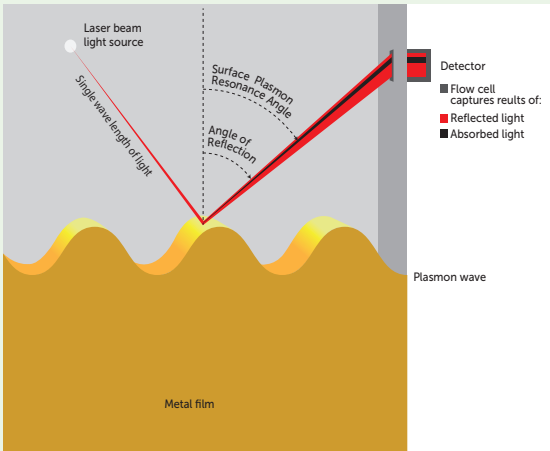
³⁰ Optech Consulting Market Research Study 24.1.2017.

High growth in European core photonics segments

Since 2011 the European photonics industry has shown a solid growth – most of the European photonics segments displaying a growth rate far above the average World GDP growth rate or the average EU GDP & Industrial Production Index growth rate. The European photonics industry grew especially strong in its already large segments like Machine Vision / Measurement and Image Processing (CAGR +5.6%), Medical Technology (CAGR +5.3%) and Production Technology (CAGR +4.7%). Today, the European Photonics industry holds high global market share in Photonics for the production technology (50%), Optical measurement & Image Processing (35%), Optical Components and Systems (32%), Photonics based Medical Technology and Life Sciences (28%), as well as in Defence and Security Photonics (26%) and Lighting (25%).

Success story


Poseidon – new light sensor to spot deadly bacteria in minutes



The risk of catching fatal Legionnaires’ disease from air conditioning units can be dramatically reduced, thanks to a new biophotonic light sensor that spots Legionella bacteria 240 times quicker than methods used today. [More](#)

Success story

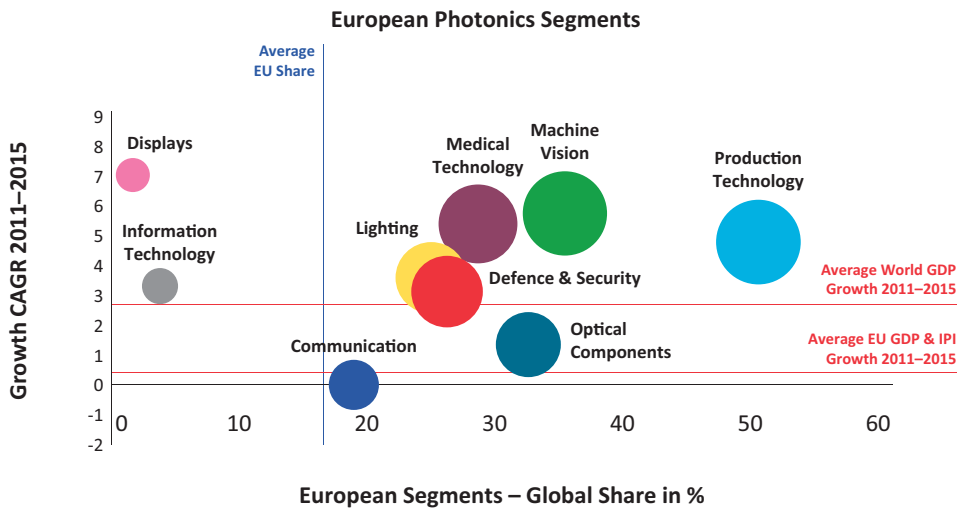
Octchip – coin-sized scanner to target blindness



Hand-held, wireless retinal scanner harnessing new photonics technology will enable early diagnosis of glaucoma and diabetic retinopathy. [More](#)

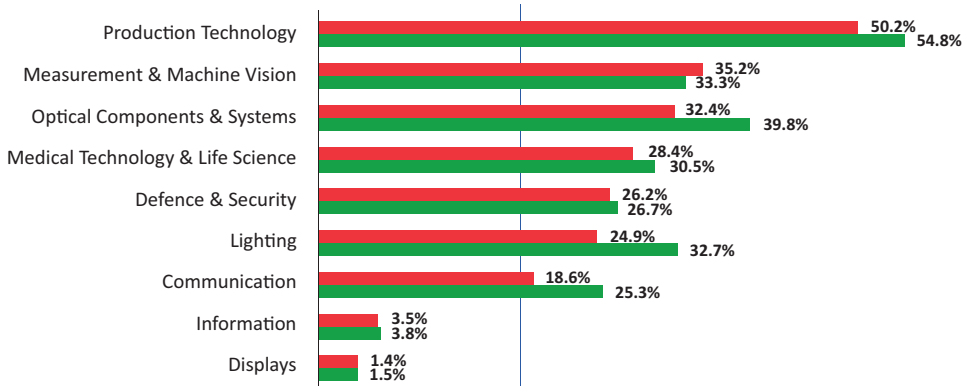
II. Jobs and Growth – Economic Impact of the Photonics PPP

Fig. 12: Average Growth rate of European Photonics Segments in the period 2011-2015 vs. Average EU GDP and IPI Growth as well as vs. Average World GDP Growth. Most European Photonics Segments were able to outgrow European and World GDP and also showed a share above the average EU GDP and IPI Growth rate in the period 2011-2015. (The size of the bubbles refers to the global market share of the European Photonics segments.) Source: Optech Consulting Market Research Study 24/01/2017.



Compared to 2011 – and despite of increasing global competition as well as the devaluation of the Euro over the last years – the European Photonics core segments remained strong and could defend a leading world position up to 50 % - far beyond the average EU industry share of 15.5 %.

Fig. 13: Global Market Share of European Photonics Segments 2011 and 2015. European core competence segments remained strong and defended a leading global position. Source: Optech Consulting Market Research Study 24/01/2017.



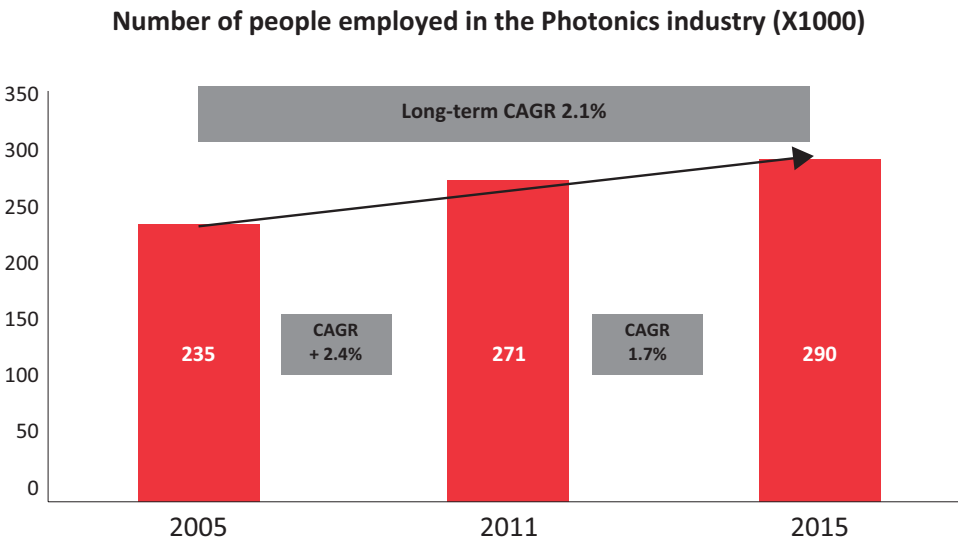
● 2015
● 2011

II.2. Photonics PPP has contributed to creating new jobs

Fig. 14: Employment in European Photonics Industry in the period 2005-2015. The European Photonics Industry has shown a steady increase of employment in the period 2005-2015 with a long-term growth rate of 2.1% p.a. Source: Optech Consulting Market Research Study 24/01/2017.

19,000 new jobs in the period 2011-2015

By the end of 2015, the EU Photonics industry employed 290.000 people – compared to 271.000 employees in the sector in 2011. This represents a CAGR of +1.7%. The growth rate has been slower in the last years than in the years 2005–2011 due to the economic crises in Europe– however, on a ten-year comparison, the number of employees in the European Photonics industry has increased from 235.000 in 2005 to 290.000 in 2015. This means that, with regard to the number of people employed in this sector, the European Photonics industry has shown an impressive overall growth of + 23% since 2005 and a solid long-term CAGR of 2.1%.



Success story

Tresclean – lotus leaf inspires scientists to create world's first self-cleaning metals

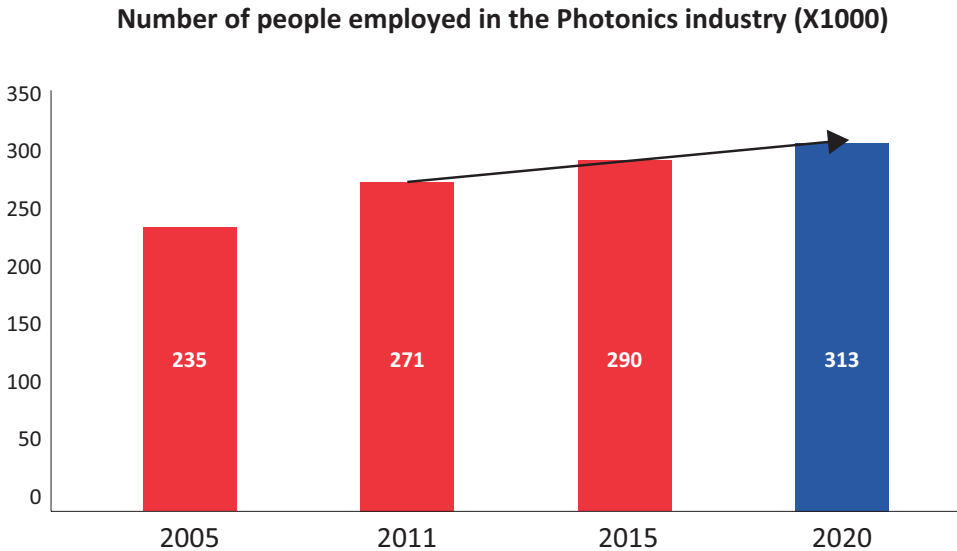


Using inspiration from nature, a team of European researchers have harnessed new photonics technology to develop the first fluid-repellent, antibacterial, metal surface taking us a step closer to self-cleaning saucepans, toilets, and dishwashers. **More**

II. Jobs and Growth – Economic Impact of the Photonics PPP

Forecast: +42.000 jobs in 2020 compared to 2011.
Estimating that the employment growth rate of 2011–2015 in the photonics segments will continue, it can be expected that by the end of Horizon 2020 the European Photonics industry will employ 313.000 people. This represents an increase of 42.000 positions versus the 2011 employment level and an estimated long-term growth rate of 1.6% for the period 2011–2020.

Fig. 15: Forecast about the likely continuation of the trend in employment in European Photonics industry. Provided the employment growth rate remains the same as in the last years, the European Photonics industry may employ 313.000 people in 2020.
Source: Optech Consulting Market Research Study 24/01/2017.



II.3. Developing skills for tomorrow’s European Photonics industry

As mentioned above, the European Photonics industry grows rapidly and much faster than GDP. To support this growth in the long term requires making sure that a growing highly-skilled photonics workforce is available in Europe – at all levels of technology development, from basic R&D to pilot projects prior to market introduction, and all levels of production chain and hierarchy, from management to manufacturing floor. The issue of skills creation and lifelong learning is particularly important against the background of demographic trends in Europe and of the related shortage of competent workforce, as well as of sharp global competition in this promising field. For companies of the photonics industry to be able to maintain their market share on the long run or to tap into new markets, it appears therefore crucial to invest in and promote skills creation and lifelong-learning in Photonics.

It is a remarkable achievement that many different PPP projects, relying on highly innovative concepts, have been initiated under the frame of the Photonics PPP with the aim at promoting skills creation for young people (at school or / and university) and for entrepreneurs and employees, as well as raising awareness for the potentials of the photonics technologies among the general public.

Success story

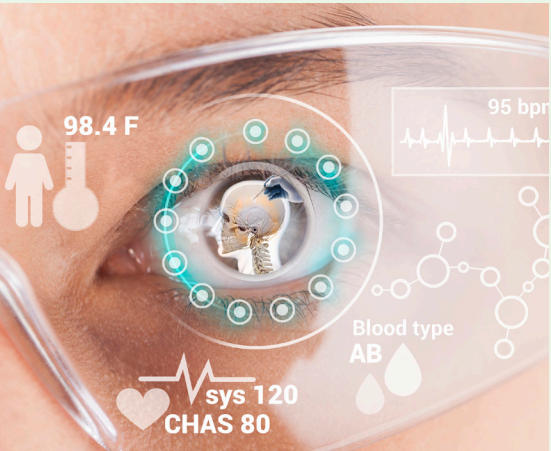
Innoderm – listening to light’ to transform diagnosis of skin cancer



New opto-acoustic device uses photonics to see blood vessels, skin oxygenation and pathophysiological features for more accurate diagnosis of skin cancer and treatment of wounds. [More](#)

Success story

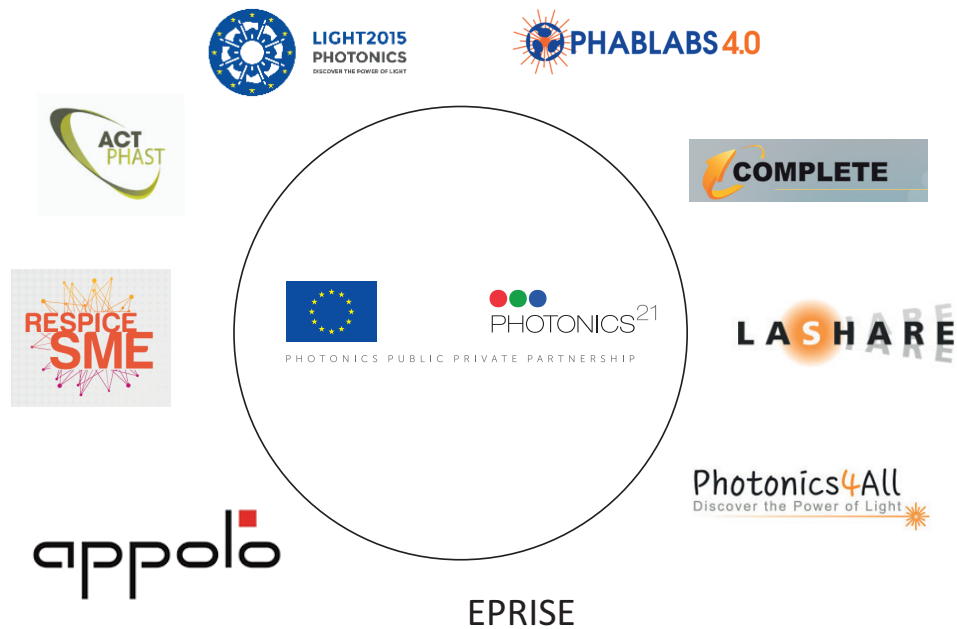
Vostars – augmented reality visor to dramatically improve surgery



Employing new photonics technology, European scientists are developing a new Augmented Reality surgical visor in a bid to improve accuracy of interventions, showing anesthetic and medical data while superimposing a patient's x-ray in perfect unison with their body, meaning surgeons never having to look away during an operation and surgery times reduced by over 20 mins for every 3 hours. [More](#)

II. Jobs and Growth – Economic Impact of the Photonics PPP

Fig. 16: The Photonics PPP contributes to promote Education, Training and Skills in Photonics as well as to raise awareness about the potential of Photonics: 9 PPP projects focus explicitly on these targets. Source: VDI TZ GmbH.



PPP activities targeting young minds at all ages

The concepts developed in the PPP Projects related to research, education and training are very diverse and targeted at different categories of people, namely:

- Activities targeted at children and teachers cover toolkits for schools, such as the Photonics Explorer developed in the project Light2015, so-called children’s universities as developed e.g. by Photonics4All, photonics games for pupils in schools as developed by Photonics4All, teachers’ trainings (from kindergarten to secondary schools) or the development of gender-sensitive material for Photonics Workshops;
- Activities targeted at universities like the Light2015 Awards aiming at honoring young photonics experts;
- Activities targeted at companies and employees cover information events “highlighting photonics as driver of entrepreneurship and industry”³¹ (cf. LIGHTtalks of the project Light2015);
- Interesting and innovative concepts are targeted at a more general public, such as the app developed by Photonics4All to encourage all interested people to learn more about light and the potential applications of Photonics, the science slams organized by Photonics4All and the iSPEX-EU campaign, being the 1st photonics experiment involving the general public and using smartphones to measure air pollution.

³¹ www.europe.light2015.org/Home/Activities/LIGHTtalks.html, last accessed on 2017/02/21.

Video 4: LIGHT2015 – Lighting the Future
Link: www.youtube.com/watch?v=C0HPNwN2hPk



Video 5: Light 2015 – Careers in Photonics
Link: www.youtube.com/watch?v=RA5VnCFbnjM



III. Teaming up with EU Member States and Regions in Europe

While EU Member States and Regions are not part of the PPP, they are connected to the Platform Photonics21 since the very beginning. In the P21 Mirror Group, representatives of national and regional funding organisations involved with photonics funding meet and update each other regularly. One core activity of this group is the preparation and the implementation of transnational calls for funding, each by a number of Member States and Regions particularly well positioned and/or interested in the specific area.

Presently, there are three ERA-Net Plus or Cofund Actions ongoing (see table below), implementing the European work programmes at a transnational and regional level and mobilising another €70–€80M from the public and the private sector for photonics research and innovation in Europe.

Table 1: Overview of ongoing ERA-Nets Plus or Cofund Actions.
Source: VDI TZ GmbH.

1. ERANET+ OLAEplus (Organic and large area electronics)
www.olaeplus.eu/

Joint Funding Volume	Member states and regions involved
€18M	UK (coord.), AT, CAT (ES), DE, FLA (BE), IL, PL
Number of projects started	Duration
10	10/2011–09/2016

2. ERANET+ BiophotonicsPlus (Photonic appliances for life sciences and health)
www.biophotonicsplus.eu/

Joint Funding Volume	Member states and regions involved
€15M	DE (coord.), CAT (ES), FLA (BE), IL, LV, TUS (IT), UK
Number of projects started	Duration
11	09/2012–08/2017

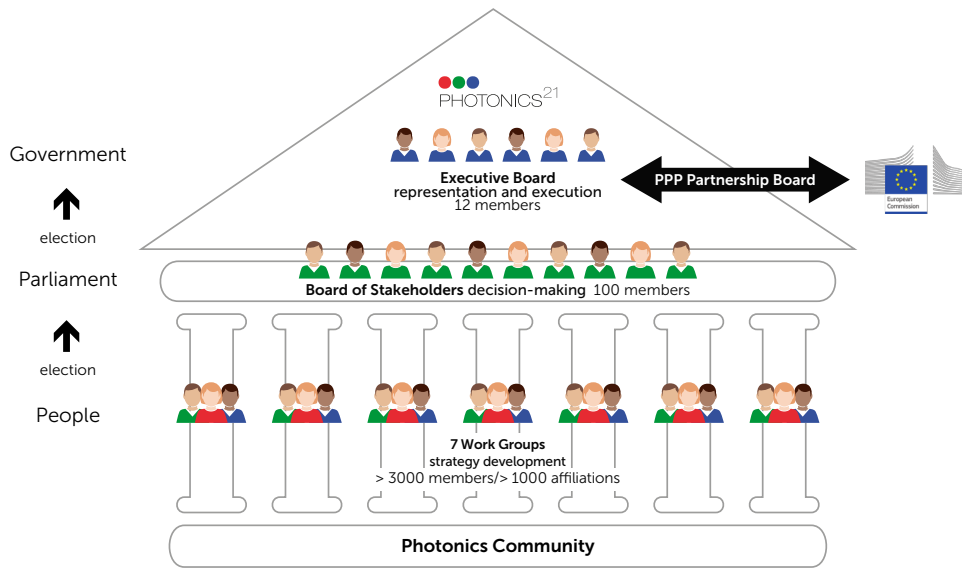
3. ERANET Cofund PhotonicSensing (Photonics based sensing)
<https://photonicsensing.eu/>

Joint Funding Volume	Member states and regions involved
€18M	AT (coord.), DE, FLA (BE), IL, PL, PT, TR, TUS (IT), UK
Number of projects started	Duration
n. a. (submission/selection ongoing)	04/2016–03/2021

IV. The Photonics PPP – Open, Transparent and Democratic Decision Making Based on Broad Community Involvement

The Photonics PPP strategy preparation and implementation relies on a close cooperation between Photonics21 Work Groups and Boards with its 3000 members from Industry and Research Organisations and the European Commission. A condition sine qua non for ensuring a fruitful cooperation between industry, science community and policy and for having all decisions taken supported and owned by all parties is to have open, transparent and democratic structures and processes.

Fig. 17: Governance structure and decision making process of the Photonics PPP. The Photonics21 community drives the Photonics PPP. Source: VDI TZ GmbH.



Decision making and responsibilities in the strategy process are based on the agreed principles³² between the European Commission and Photonics21.

- The strategy development and the identification of research and innovation priorities rely on the three organisational layers of the European Technology Platform Photonics21 with following roles and tasks:
- The Work Groups (WGs) are the major source of strategy development (Multiannual Roadmap and R&I priorities) within the ETP Photonics21
 - The Board of Stakeholders (BoS) reviews the outcomes of the work group strategy and votes on the strategic priorities.
 - The Executive Board (EB) coordinates the input of the work groups and executes the decisions of the Board of Stakeholders. In this role, it is the mouthpiece of the ETP Photonics21 towards the European Commission in the Photonics21 PPP.
 - The Photonics PPP Partnership Board is consisting of the two partners of the PPP, the democratically elected Photonics21 Executive Board and the European Commission. The Partnership Board is responsible for the implementation of the PPP strategy.

³² See Photonics21 website: www.photonics21.org/download/Photonics-PPP/Photonics-PPP_Research--Innovation-Process.pdf?m=1485867632

IV. The Photonics PPP – Open, Transparent and Democratic Decision Making Based on Broad Community Involvement

7 Photonics 21 Work Groups focus on the following issues:

- WG 1: Information and Communication;
- WG 2: Industrial Production, Manufacturing and Quality;
- WG 3: Life Science and Health;
- WG 4: Emerging Lighting, Electronics and Displays;
- WG 5: Security, Metrology and Sensors;
- WG 6: Design and Manufacturing of Components and Systems;
- WG 7: Photonics Research, Education and Training.

Decision making in Photonics21 Work Groups is based on agreed principles:

- Photonics21 work groups are responsible to provide research and innovation topics for their specific photonics application areas. In the further process Photonics21 provides the final work group proposals to the Board of Stakeholders as decision making body of the platform which consists of 100 – democratically elected by work group members – companies and research organisations.
- Decisions in work groups are taken either by consent or majority voting.
- Once a decision has been taken by the work group members on a specific topic/draft it is in principle regarded as definite. If, for whatever reason, an agreed draft/topic should be opened again, this can only be done with the consent of the work group chair and of at least 10% of the work group members (being WG members at the time the decision was taken).
- Any dispute that may arise between the chairman of the work group and individual member(s) or a subgroup(s) of the work group should be resolved in good faith by both sides. In case an issue cannot be resolved, member(s) or the sub group of the work group can address the Executive Board in order to decide on the issue at dispute. Both sides are obliged to follow the decision of the Executive Board (vote) on that issue.

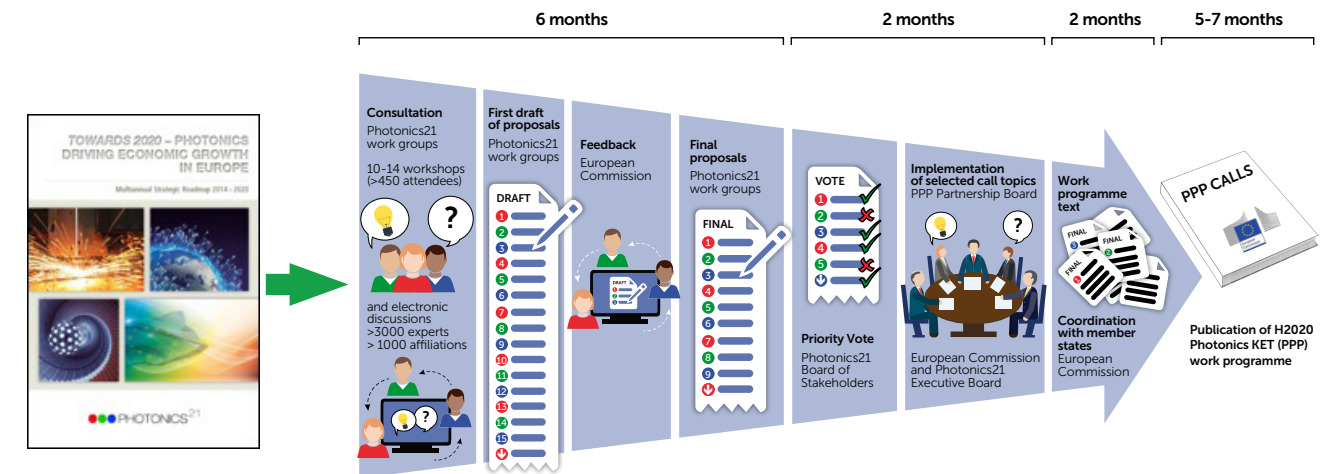


Fig. 18: Structure of the Photonics PPP call priority process.

Source: VDI TZ GmbH.

Broad community involvement and support is a decisive factor for the success of the PPP. Through the application of the Photonics21 processes more than 3000 Photonics21 members from industry and science are involved. The Work Groups meetings in 2014–16 alone had more than 1300 attendees.

Conclusions: a solid foundation for Photonics to continue growing stronger

The rise from a niche technology sector to one of the most important industries for the future of Europe is closely related to long term funding of the European Commission and a strong commitment of the European photonics industry. All stakeholders of the European Photonics have been working together for years to develop and continuously update the European R&D strategy in Photonics in open, transparent, democratic and participative decision making processes and to promote the implementation of this strategy in the framework of Horizon 2020. The success achieved so far – as highlighted in this Impact Report – underlines that we have struck the right path. What´s even more important: Photonics has a substantial leverage effect on other key industries in Europe and provides solutions to make them more competitive. 20–30% of the overall economy and 10% of the workforce in Europe depend on photonics.³³ This encourages us to continue on the path we have chosen beyond Horizon 2020 so as to reap the full benefits of Photonics applications in terms of creating jobs and wealth in Europe.

³³ Butter, M., Leis, M. et al. (2011): The leverage effects of photonics technologies: the European perspective. Study prepared for the European Commission, DG Information Society and Media, SMART 2009/0066. Available under: http://cordis.europa.eu/fp7/ict/photonics/docs/reports/photonicsleveragestudy_en.pdf, last accessed on 2017/03/21.

