

Photonics: A Key Enabling Technology for Europe

WHY SHOULD REGIONS INVEST STRUCTURAL FUNDS IN PHOTONICS?

Photonics is everywhere around us: from communications and health, to lighting and photovoltaics and to everyday products like DVD players and mobile phones.

Photonics is a fast-growing business sector, with a global market of around € 350 billion, projected to reach over € 600 billion by 2020. Europe has established a strong position with an overall total share of approximately 18 % (€ 66 billion in 2012)¹. The European photonics industry employs more than 300 000 people directly, many of these in the over 5,000 photonics SMEs often structured in national and regional innovation clusters which represent a highly educated workforce.

The European Commission defined photonics as one of the six Key Enabling Technologies (KETs) of Europe². Indeed, photonics has a substantial leverage effect on the European economy and workforce: 20-30 % of the economy and 10 % of the workforce depend on photonics³.

Photonics is a very dynamic and vibrant industrial sector in Europe that holds the potential for huge market growth. The expected compound annual growth rate for photonics over the coming years is 8 %, clearly demonstrating the rapid growth of this key technology sector. Major growth is expected in lighting, medical technologies and life sciences, laser-based manufacturing and optical communications. These are the areas where the European photonics industry is particularly strong. A detailed analysis about photonics in Europe and its future development and market perspectives was provided in the main KET⁴ and Photonics⁵ specific reports.

Photonics technologies provide competitive advantages to vital manufacturing industries in Europe. The increased demand for greener technology and carbon neutral energy generation, for ever greater data bandwidths, for better and cheaper healthcare solutions for an aging population or for better and higher quality lighting provide huge opportunities for rapid market growth, in particular for broadening the applications space.

BARRIERS AND CHALLENGES

The key challenge for regions is to make an economic assessment of where photonics can be used to create regional growth and jobs. This will allow them to identify where are the economic niches and competitive advantages in photonics development and deployment activities. Regions should be aware of key guiding principles, such as: what are the industrial needs with regard to photonics technologies? Who are the main actors in their regions, who are the potential customers of these technologies? What is their cooperation potential along the value chain and what are promising business cases that can be created in terms of market development and exploitation?

The Commission is in the process of setting up a Public Private Partnership (PPP) in Photonics under the EU's new Research and Innovation (R&I) framework programme for 2014-2020 (Horizon 2020). This PPP aims to establish a long-term commitment between the Commission and the Photonics Stakeholders to invest in Europe and establish a European R&I strategy and more broadly a

¹ EPIC/TEMATYS Report "Photonics Ecosystem in Europe", April 2013

² COM(2009) 512: KETs are knowledge-intensive and associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly-skilled employment. They enable process, goods and service innovation throughout the economy and are of systemic relevance. They are multidisciplinary, cutting across many technology areas with a trend towards convergence and integration.

³ The leverage effect of photonics technology: the European perspective, European Commission's study SMART 2009/0066, http://www.photonics21.org/download/Leverage_Internetversion.pdf

⁴ http://ec.europa.eu/enterprise/sectors/ict/files/kets/hlg_report_final_en.pdf

⁵ http://ec.europa.eu/enterprise/sectors/ict/files/kets/photonics_final_en.pdf

European industrial strategy in photonics. In this context, Photonics21, the European Technology Platform in photonics published in April 2013 a multi-annual strategic R&I roadmap defining the main photonics R&I priorities for the period 2014-2020 (see reference [1] below).

This strategic roadmap is a very useful reference documents for regions having plans to invest in photonics. It identifies technologies fields and innovation opportunities for Europe to develop in the next 7 years which can be a very valuable input for regions to develop their own RIS3 plans.

HOW TO ACT?

The following elements could be very useful to consider for regions wishing to develop regional strengths in photonics:

- a) *Identify the main fast growing photonics industrial sectors and the main stakeholders* in your region (industry, incl. SMEs and end-users, universities, research institutes, competence centres, etc.); make a SWOT analysis of their capabilities and skills as well as of their competitive advantages; in particular, assess the opportunity in affecting the innovation potential of user industries excelling in application areas and industrial sectors present in your region;
- b) *Engage with the stakeholders*: set strategic R&I priorities (expressed in your RIS3 operational programmes); develop roadmaps to reach the set goals, and define implementation actions for the main actors to work together and spur forms of innovation or specialisation. Examples of potential lines of action are provided below;
- c) *Identify / link with other similar activities* at EU level to help your stakeholders find opportunities for cooperation and growth outside your region / country;
- d) develop a *planning and monitoring framework* based on a number of key performance indicators to measure progress against the objectives and assess the expected impact; Relevant Key performance indicators for KETs in general and photonics in particular are provided both in the KETs High-Level Group Report⁴ and in the Photonics Multiannual Strategic Roadmap 2014 – 2020 (see Ref. [1] below).

Below, a number of possible lines of action are proposed. They permit to bring together the main stakeholders and develop opportunities for innovating along and across the value chain(s):

Structuring the regional stakeholders around an Innovation Cluster: Innovation clusters play a pivotal role in promoting R&I investments in a region. They bring together the main industry and academic stakeholders, investors and regional and government agencies with the aim to generate synergy among the players in R&I in one or more given markets; and, to stimulate the creation of ***sustainable value chains and business ecosystems*** that build on complementarities between the different players, including user communities, with a view to creating new competitive advantages. Therefore, it is important for the regions to strengthen an existing photonics innovation cluster which is able to sustain regional growth in the long run, and to ensure appropriate funding support. Excellent clusters are a must to develop and implement effective regional RIS³. The report [6] below provides a list of actions and approach on how to use clusters for designing and implementing smart specialisation strategies.

Linking value chain activities through cross-cluster and cross-region cooperation: Full photonics value chains do not exist in many regions. Cooperation between photonics players and end-users in different clusters of a region or in different regions provides opportunities to work along full value chains to expand the business of local photonics industries. Stimulate the creation of new excellence based on an efficient networking and cooperation of different clusters in your region and promote internationalisation, including trans-national cluster cooperation. Experience so far shows that the cooperation between clusters operating in different regions and in different business sectors is essential to support emerging industries and to create world leadership in new areas.

→ Under the new structural funds, it is possible for a region to invest up to 15% of its budget to another region if the beneficiaries are from this region. This would stimulate cross-regional collaboration, by providing e.g. access for the beneficiaries of one region to manufacturing capabilities or other innovative services of another region.

In Europe, there are now more than 40 regional photonics innovation clusters and national technology platforms⁶. The European Commission's approach is to help these clusters reinforce their excellence and their attractiveness to investors and to young talents. Through supporting their networking, it helps them bring together regional ecosystems and develop sustainable business partnerships all along the value chain.

An example of such an approach is the ICT FP7 project **ASPICE** dealing with photonics cluster cooperation and internationalisation. Success of inter-cluster collaboration is strongly related to the quality of inter-cluster project collaborations launched. ASPICE has developed a management tool for cluster collaboration which maps the different available competencies and skills along value chains and has defined a number of metrics to measure the success of inter-cluster collaboration. These tools are available at <http://www.fp7-aspice.eu/results.aspx>.

Supporting Innovative SMEs: SMEs lie at the very heart of the European photonics industry. They are driving innovation and economic growth. Regions can undertake the following actions to support SMEs competitiveness and further growth: (i) Stimulate access to regional / European feasibility, testing, prototyping and manufacturing capabilities for photonics research-intensive and end-user SMEs. (ii) Stimulate R&I activities involving SMEs both as part of the value chain collaboration and through specific actions aimed at SMEs. In particular, open innovation models along the value chain can further promote the collaboration between large industry and SMEs; (iii) Support the development of open-access pilot line and foundry services (see below) that provide SME access to photonics manufacturing capabilities.

ACTMOST is an EU ICT project (<http://www.actmost.eu/>) which provides access services⁷ enabling the wider adoption and deployment of photonic technologies in innovative products, in particular by photonics or user SMEs and driven by their business needs. The action is driven by photonics research excellent centres and will continue its activities in the period 2014-2016 in close cooperation with national and regional photonics or user related clusters.

Supporting Photonics Manufacturing Platforms & Pilot Production Lines: Regions could explore the opportunity they may have to grow photonics manufacturing. This can be achieved at two levels; enabling the photonics products themselves to be manufactured in a region, and ensure that other key manufacturing sectors in Europe, dependant on photonics technology, can remain competitive. To this end the following measures could be implemented:

- Supporting the development of open access pilot photonic manufacturing facilities at regional excellence centres for supporting industry, especially innovative SME's. Such pilot facilities will enable cost-effective and widespread deployment of photonics technology in numerous applications, and ultimately lead to high volume production.
- Supporting the creation of pilot production facilities, in which industry and research institutes can jointly develop innovative photonics production processes, targeting applications relevant to societal challenges and economic growth.

→ KETs and photonics will take up a prominent role in Horizon 2020. One of the main new issues is that Regions will be able to more easily combine different EU instruments in order to support their local economic ecosystems. In the future, several EU funding tools can be combined for the financing

⁶ An overview of photonics innovation clusters is available at http://cordis.europa.eu/fp7/ict/photonics/clusters_en.html

⁷ Access services provide fast access to knowledge, training, prototyping, testing, manufacturing, design or engineering services for first users and early adopters, in particular SMEs. The objective is to reinforce the competitiveness of users by enabling them to exploit innovative photonics technologies.

of one operation (for example the creation of a pilot production line), given that the expenditure is not double-financed and general state aid principles are followed. In addition, the Commission will cooperate with the European Investment Bank in order to provide loan guarantees to productive investments. Overall, a coherent financial framework will be put in place in order to support development and innovation stages of KET- and photonics related processes.

Supporting Large Scale Deployment Actions (e.g., for Lighting the Cities with LEDs and Intelligent Lighting Systems): Regions could invest in large scale demonstration actions and public procurement schemes that promote innovation for an effective field testing and deployment of innovative photonics technologies in application fields where public authorities can act as first users. Illustrative examples include: innovative lighting for the cities; cancer tissue diagnostics and treatment technologies for hospitals; or the pilot deployment of innovative ubiquitous broadband fibre access technologies in residential areas by using European next-generation optical access technologies.

A report on '**Lighting the cities – accelerating the deployment of innovative lighting in European cities**' was published in June 2013. It provides concrete guidelines on how best to proceed with the deployment of LED lighting in European cities. The report and its annexes is available at: http://cordis.europa.eu/fp7/ict/photonics/digitalagenda-and-ssl_en.html

FURTHER READING & FORTHCOMING EVENTS

- [1] *Towards 2020 – Photonics driving economic growth in Europe*, Photonics Multiannual Strategic Roadmap 2014-2020: http://www.photonics21.org/download/Brochures/Photonics_Roadmap_final_lowres.pdf
- [2] *Lighting the Cities - Accelerating the Deployment of Innovative Lighting in European Cities*, European Commission, June 2013, http://cordis.europa.eu/fp7/ict/photonics/digitalagenda-and-ssl_en.html
- [3] *The leverage effect of photonics technology: the European perspective*, European Commission's study SMART 2009/0066, http://www.photonics21.org/download/Leverage_Internetversion.pdf
- [4] *Photonics Technologies and Markets for a Low Carbon Economy*, European Commission's study SMART 2010/0066, <http://www.photonics21.org/download/Brochures/Photonics21-Internet.pdf>
- [5] *Photonics Innovation Clusters in Europe*: http://cordis.europa.eu/fp7/ict/photonics/clusters_en.html
- [6] *Guide to Research and Innovation Strategies for Smart Specialisations (RIS 3)*, European Commission, May 2013, http://www.qren.pt/np4/np4/?newsId=1334&fileName=guide_research.pdf