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Strategic Recommendations for the Development of France's Optics-Photonics Sector

Optics-Photonics: a scientific and industrial reality

Technological developments over the last 30 years have contributed to the emergence of a global optics-photonics industry. Photonic components are now at the core of monitoring and safety systems,

European photonics production generates 43 billion euros in annual revenues, and accounts for 19% of the world market while employing 245,000 people.

medical equipment, telecom solutions and measurement instrumentation. Europe already has many research skills and a significant industrial network in all photonics-related sectors.

In addition, the European Commission recognizes photonics as one of five key technologies along with advanced materials, nanotechnology, micro-nanoelectronics and biotechnology. A high-level group, comprised of 24 European personalities, is committed to proposing a strategy of industrial development concerning these key technologies by mid-2011.

France's scientific and industrial environment is also highly developed and its global leadership is recognized in many areas. Starting with industrial know-how of the technological building blocks (materials and components), France possesses industrial value chains for which photonic's

French industrial production in optics-photonics involves 1,000 companies, 50,000 direct jobs and 150,000 indirect jobs*

distributive nature, particularly as an enabling technology, contributes to the competitiveness of businesses. Generally speaking, French industrial activity in photonics encompasses the entire industrial spectrum ranging from a few large corporate groups, start-ups which often reflect strong regional dynamics, as well as SMEs and a small number of medium sized companies.

The French industrial environment is similar in size to that of Germany, and somewhat higher in the category of corporat groups, with growth at the start-up level, but lower for SMEs and medium sized companies.

French R&D strengths and goals

Current and future developments in optics-photonics greatly depend on French players' ability to innovate. Ensuring this requires a collective strategy combining the forces of the research and training communities with industry and public authorities. Beginning in 2010, CNOP – the National Committee of Optics and Photonics – undertook to identify key technologies and to formulate recommendations aimed at ensuring the industrial development of the sector in France. This approach, pursued in the context of the Assises nationales de l'optique-photonique (French Optics-Photonics Congress), was conducted in four phases:

- Bibliography of French R&D investments
- Organization of five workshops involving 150 experts
- Identification of key technologies and related recommendations
- Public report at the Opto-Photon Recherche Industrie expo in Paris on October 26, 2010

21 technological orientations, covering 6 fields, emerge as priorities, in the sense that France has real advantages for its scientific and industrial development:

TELECOMMUNICATIONS

Short-distance optical transmissions
Fiber-optics and components
Systems and networks

HEALTH AND LIVING SYSTEMS

Photonic systems for health analysis
Medical imaging systems
Photonic sensors for living systems
Lasers for health

ENERGY, LIGHTING, DISPLAY

LED & OLED
Solar Photovoltaic
Optics-photonics technologies
for major research infrastructures
Display and augmented reality

MANUFACTURING AND CONTROL

Lasers and industrial processes
Manufacturing techniques for optical systems
Industrial processes and optical measurements

MONITORING, SAFETY, SPACE

Complex imaging systems
for observation and monitoring
Image sensors
Sources, sensors and sensor networks

MATERIALS AND GENERIC TECHNOLOGIES

Nanophotonics and thin-layer optics
Microelectronics and photonics
Technologies and laser sources
New materials and components

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But these 21 orientations do not reflect equal levels of scientific and industrial strengths and weaknesses, or business prospects, for that matter. The mobilization of communities or the implementation of support mechanisms or tools for the sector must take these differences into account.

For six of the twenty-one orientations, France has a **consequential scientific and industrial value-building chain**, starting at the research level and extending to integration or use of optics-photonics technologies. Furthermore these R&D orientations target economic opportunities in market segments of substantial size

and growth prospects. This is the case of the three orientations related to Monitoring, Safety and Space - "Complex imaging systems for observation and monitoring", "Image sensors", "Sources sensors and sensor networks" - two Telecom orientations - "Fiber optics, and components," "Systems and networks," as well as for "optics-photonics technologies for major research infrastructures."

For these six orientations, it is important to leverage the value chain effects, by specifically developing programs that bring together these scientific strengths, the numerous technological SMEs and integrators.

During the first "Assises nationales de l'optique-photonique" on October 26 in Paris in the context of the Photon Recherche Industrie expo an overview of these 21 orientations will be presented, followed by a discussion

In 11 of the 21 orientations, France possesses significant scientific and technological strengths and a **strong innovation dynamic contributed by SMEs**. Some of the markets targeted by these R&D orientations are emerging, but for them the enabling aspect of optics-photonics promises interesting economic benefits. Other orientations present greater maturity, although in these cases the integrators are not always very active in France. This concerns four orientations relating to materials and generic technologies - "Nanophotonics and thin-layer optics," "Microelectronics and photonics," "Technologies and laser sources," "New materials and components,"

four orientations related to health and living systems - "Photonic systems for health analysis," "Medical imaging systems," "Photonic sensors for living systems," "Lasers for health" and "Solar Photovoltaic", "LED & OLED" and " Manufacturing techniques for optical systems".

Finally for four orientations, by relying on **scientific and technological know-how**, the industrial network

warrants development. These technologies target applications for which economic prospects are proven, but French industrial dynamics are not currently at the same level as that observed abroad. This applies to the orientations of "Lasers and industrial processes," "Industrial processes and optical measurements ", " Short-distance optical transmissions" and " Display and augmented reality".

10 Strategic Recommendations for the French Photonics Sector

EIn regard to the French benefits and goals for industrial development, each of the 21 orientations could be the subject of an individual strategic development plan. But at this point, we highlight the formulation of recommendations for the entire optics-photonics sector. The sector at the national level is embodied above all in the diversity and excellence of research laboratories and companies. But this sector is undergoing restructuring at all levels. At the regional level, seven organizations are particularly active: the competitiveness clusters - Alpha Route des Lasers, Elopsys, POP-sud-OPTITEC- and other clusters – Anticipa, Opticsvalley, Pôle Optique Rhône-Alpes, Rhenaphotonics Alsace. These organizations promote training, research and industry players and support innovation and economic development in their community of players.

These 10 strategic recommendations address all sizes of companies, from SMEs to major corporations, as well as laboratories and research organizations, training institutions, regional, national and European public authorities, professional organizations and clusters, because only a concerted mobilization can guarantee rapid and sustainable development of the French optics-photonics sector.

Nationally the Société Française d’Optique is promoting the sector as a scientific discipline and vector of technological innovation, while the AFOP trade association represents the profession and provides many services to businesses.

By creating the Comité National d’Optique-Photonique in 2003, these nine organizations hope to leverage the benefits of unified efforts, to promote complementarity and share resources to contribute effectively to the development of the national optics-photonics sector.

The CNOP facilitates the convergence of regional or national innovation support measures to better serve the sector at the national level.

Nevertheless, in order to affirm France’s position in European and global optics-photonics and contribute to increased economic and scientific value produced in France, it is urgent to mobilize.

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10 Strategic Recommendations for the French Photonics Sector

1 - Strengthen French industrial control

- **Why?** In a few sectors France has true mastery of the value chain and therefore possesses solid foundations on which to build tomorrow's industrial development. This concerns photonics for monitoring, safety, scientific instrumentation, and telecom.
- **How?** By supporting integration and **systems experimentation** for one or two platforms of national scope on behalf of national reference centers already implemented by the government.

2 - Combine deployment of digital communication infrastructures in France with a business support policy

- **Why?** In terms of performance equivalencies, France has highly innovative resources at both the industrial and scientific level, and it would be counterproductive for French investments to favor foreign companies.
- **How?** By encouraging experimentation within French companies and contributing to the **creation of consortia of companies**, focused on components and equipment, and working as operators.

3 - Increase support for industrial R&D in technologies where SMEs and medium-size companies are particularly active

- **Why?** The goal is to help ensure growth in SMEs/medium-size companies by reducing time to market for innovations.
- **How?** Through increased support of photonics R&D in competitiveness clusters, through the emergence of one or two Technological Research Institutes dedicated to photonics, and by developing new forms of support for design, testing and experimentation of new products originating with SMEs/medium-size companies.

4 - Associate industrial expertise in major national research programs

- **Why?** These major programs; such as large lasers for physics (Laser MegaJoule, HIPer, Isle), satellite-based Earth observation (CNES, ESA), and ground-based observation (EELT, VIRGO, Concordia), etc., enable businesses in the optical industry to invest and develop innovative approaches to reinforce their competitiveness.
- **How?** By capitalizing on French industrial **expertise**, particularly that of **SMEs/medium-size companies** in the preliminary phases of these major programs which formulate technological challenges and related specifications, as well as in the downstream phases, through economic promotion through technology transfer of scientific results; by developing a "Small Business Act" approach to these French public investments.

5 - Attract productive foreign investment

- **Why?** France has gaps in its industrial network concerning a certain number of technologies, for example in health, despite an extensive supply of components and subsystems.
- **How?** Through concerted actions between professional representatives of the photonics sector and the government and its agencies such as AFII, and **by facilitating the establishment of foreign production plants and R&D centers.**

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6 - Increase research in generic technology

- **Why?** These disruptive technologies have represented the bedrock of innovation over the last 10 years. Their economic impacts are difficult to measure, but very strong global competition requires preparing for the renewal of product portfolios within French companies.
- **How?** By creating a dedicated call for optics-photonics projects through the ANR with a budget of €20 M, as well as by better integration of photonics in national budgets for innovation, within Nanolnnov or the Instituts Carnot.

7 - Strengthen links between research and industry

- **Why?** Renewal of products and technologies within companies greatly depends on an effective and lasting relationship with research laboratories.
- **How?** By integrating the human resources policies of large public research institutes, including CNRS, CEA, ONERA, and INSERM, and applying a determined approach to assignment of optics-photonics research scientist to industry, including in SMEs and medium sized companies. These 3-year assignments should be explicitly promoted in the evaluation of researchers. Professional organizations could serve as gateways between human resources departments and receiving companies.

8 - Influence the European Commission's orientations and support the participation of French companies in instances of discussion and calls for projects

- **Why?** Because in addition to the financial support for R&D represented by the European calls for projects, useful partnerships with European industrialists should be established, in particular concerning technologies for which France does not have a complete value chain.
- **How?** Through a concerted presence between French representatives in deliberative bodies, such as "Key Enabling Technologies" and through programs to accompany French SME/medium-sized companies in their R&D partnership strategies.

9 - Increase French presence at the international level

- **Why?** Optics-Photonics SMEs/medium-sized companies are active exporters and need additional support in their international development.
- **How:** By setting up a photonics export plan through government agencies such as UbiFrance and Oseo, and through development of international technological cooperation programs backed by the ANR or Oseo.

10 - Support funding for SMEs

- **Why?** In Europe, and particularly in France, SMEs seeking financing have difficulty convincing capital investors and banks to invest in the technology sector and support the development of SMEs.
- **How?** By developing an internationally focused optics-photonics financing conference in France, through the organized support of companies in their search for capital and by a better understanding and integration of the sector's stakes by government agencies such as Oseo and the CDC.