

Creating value in the Dutch HighTech Photonics Delta

Exploiting the Dutch world-class knowledge position in Photonics by realizing the photonics-electronics value chain including commercialisation, will provide a new impulse to our industrial position in high-tech production technology and sustained economic growth.

Focus

The Dutch High-Tech industry is increasingly embracing photonics-electronics in its innovation. Photonic technology – the utilization of light – is maturing rapidly and will play a decisive role as enabling technology in several markets. By selecting Photonics as one of the five Key Enabling Technologies, the EU has acknowledged its importance for our society. By focusing on the value chain a smart and strong ecosystem can be realized in the Netherlands by including disciplines like design and simulation, Photonic IC (PIC) development, microelectronics, manufacturing, packaging/assembly, processes/equipment and (beyond) prototyping. The Netherlands has already shown to be successful in bringing together players in a value chain (e.g. OEMs with subcontractors with unique knowledge: ASML, FEI, Thales). The photonics industry is still in an early phase. Unique for the Netherlands is that all photonics expertise is available and when matched to our High Tech strength, the industry will become a major player in this field.

Impact on Topsectors

Society begins to embrace the benefits that photonics brings by exploiting the unique properties of light helping to solve major societal needs. The progress in photonic technology is striking and many market sectors already begin to utilize its immense potential. E.g. the progress in digital communication (internet, e-commerce), the emerging of solid state lighting and solar cells, healthcare and manufacturing processes would not have been possible without its photonic components and systems.

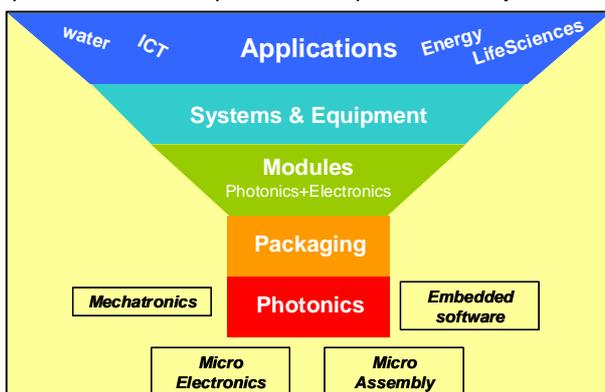


Figure: Photonics is a Key Enabling Technology (KET). It enables a full value chain, as depicted in the figure, with a market volume which is much larger than the market of the KET itself, visualized by the increased market volumes of modules, systems and the many applications

In particular, the merging of photonics with micro/nano-electronics provides a common basic platform technology capable for many applications in many markets like medical and health care, data processing, communication, consumer infotainment, machine control, sensors and security, avionics, automotive, water and space markets. The enabling character of the photonics industry matches very well with the new application Top Sectors like Water, Agrofood, Horticulture, Life sciences and Energy and can be one of the technology “backbones” of the High Tech sector (see figure).

Market

The current global photonics market (2010) is estimated 300 B€, and the leveraged *impact of photonics in other enabled industries* is substantially higher in terms of turnover and employment levels. Europe counts for 60 B€ of which the Netherlands contributes **5 B€** including SMEs. Despite the impact of the recent economic crisis, the annual growth rate of the photonics sector is higher than 10%, which is 2-3 times faster than the overall growth of European GDP. Dutch industry (internationals and over 150 SMEs) participate in this exciting field. Upcoming economies like China and Korea are rapidly catching up but do not (yet) have the design knowledge and infrastructure in photonics technology as we have.

Technology roadmap

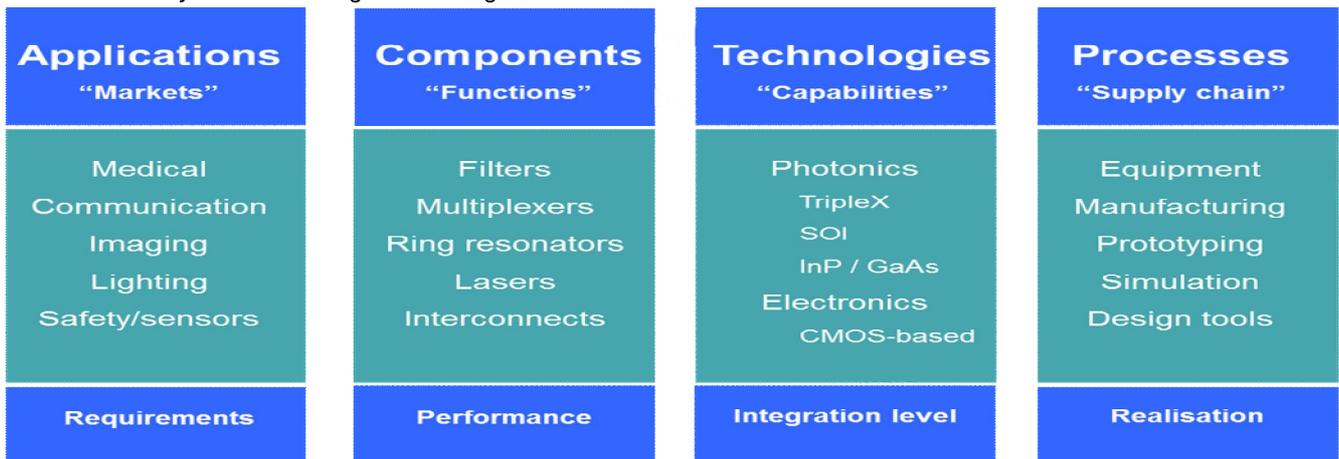
The Netherlands has invested substantially (300M€) in micro and nanophotonic technology in the last two decades and our R&D has achieved today a prominent position in Photonics in Europe. E.g. today, Dutch R&D groups perform almost 35% of the 60M€ European photonics projects on generic photonic integration technologies.

The focus has now shifted towards commercial applications. A recent photonics roadmap study (2009) has clearly pointed out that the Netherlands should:

- Complete the value chain* by stimulating also photonic product development, pilot production, system engineering and product commercialization;
- Joint development of micro/nano-photonics and micro/nano-electronics* for product innovation creating many applications in many different market sectors;
- Focus on generic photonic platform technologies* (SOI, InP/GaAs, TriPleX) including packaging and assembly technologies resulting in reusable cost efficient product- and production processes;
- Invest in education* in electronics and photonics in a common curriculum (Universities, but in particular in HBO and MBO).

Organisation

The opportunities of merging photonics and electronics and the benefits of generic foundry-based technologies is addressed in three major national R&D-programs: IOP Photonic Devices, Smart-Mix "Memphis" and STW's "Generic Technology for Integrated Photonics" which initiated successful collaborative consortia between industry and universities and have put the Netherlands at the forefront of Photonics technology development. In particular the Memphis project - in which 24 national and international partners (IMEC, Oclaro) join forces and addresses the *hybrid and heterogeneous integration*



Value chain of Photonics/Electronics Technology sector

Plan

Organising the photonics-electronics value chain in High-Tech Systems and exploiting the available knowledge and infrastructure results in focus of our efforts in:

- Identify specific **applications** where photonics can bring unique advantages including system engineering and use these applications as the R&D carriers;
- Development of photonic and electronic **components** to serve these applications;
- Development of key **generic platform technologies** for (low-cost) volume and/or high added value production, towards development and use of commercial production facilities combining best of both worlds in photonics-electronics;
- Development of industrial **processes and equipment** for generic packaging, assembly and interconnects but also software simulation tools;
- Education and training of engineers and scientists to fill the created job opportunities on a high level;
- Continue research in photonics aimed at future needs in the value chain
- Stimulating the interaction between university research and industrial development to optimize the valorization
- Setup of brokerage to match market needs and technology possibilities.

opportunities for photonics/electronics. The strength of this program is its four level approach:

- applications, setting system requirements and commercial outlet,
- photonic-electronic components for building the applications including interconnect technology
- near-future technology developments like the heterogeneous integration platform including the mutual interfacing of the basic sub-technologies (TripleX, SOI, InP/GaAs) as well as,
- processes, including production machines and development tools to better meet the technological requirements.

This approach will result in a significant contribution of the enabling photonics technology to the Top Sector market segments by bringing applications into the valorization phase, generating industrial growth and creating many high level jobs.

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