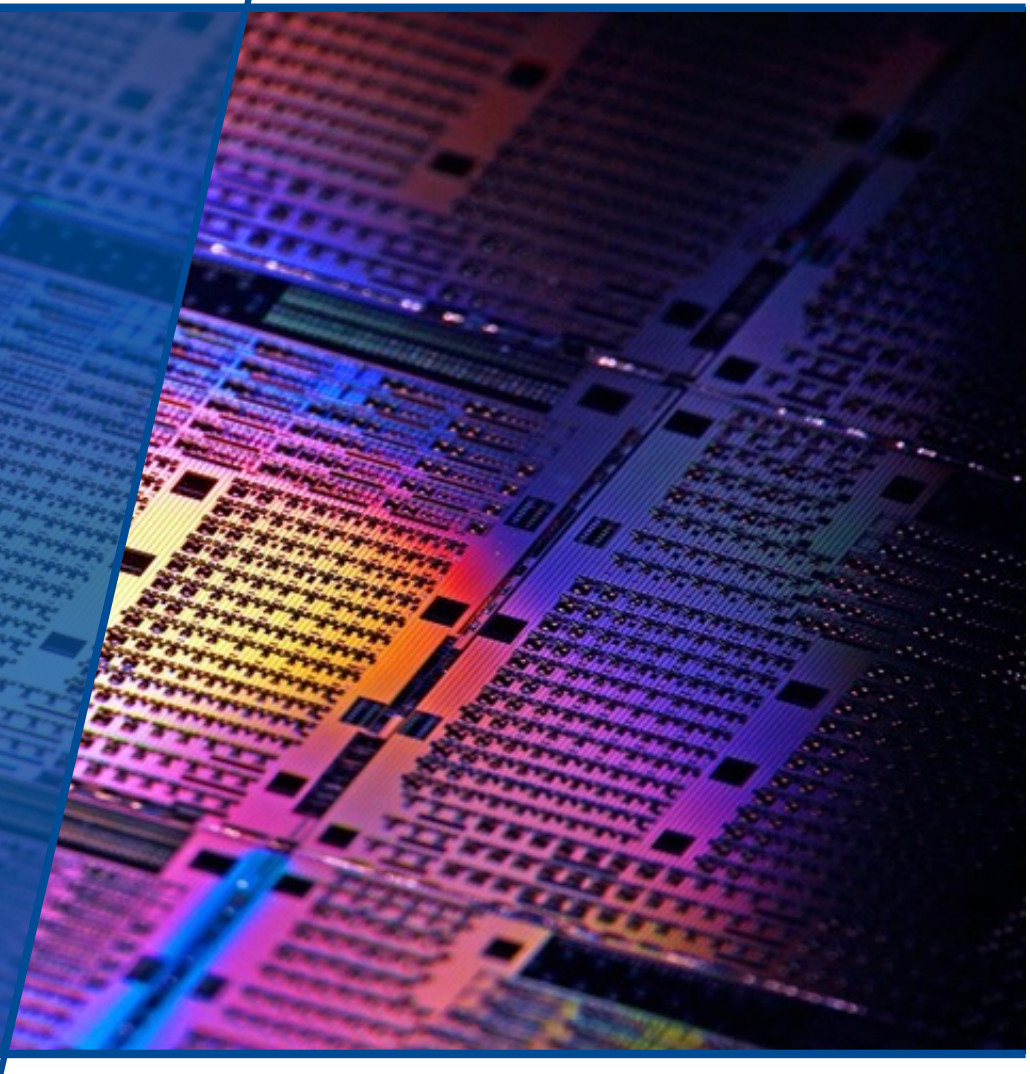
Institute for Photonic Integration and Photon Delta



Ton Backx

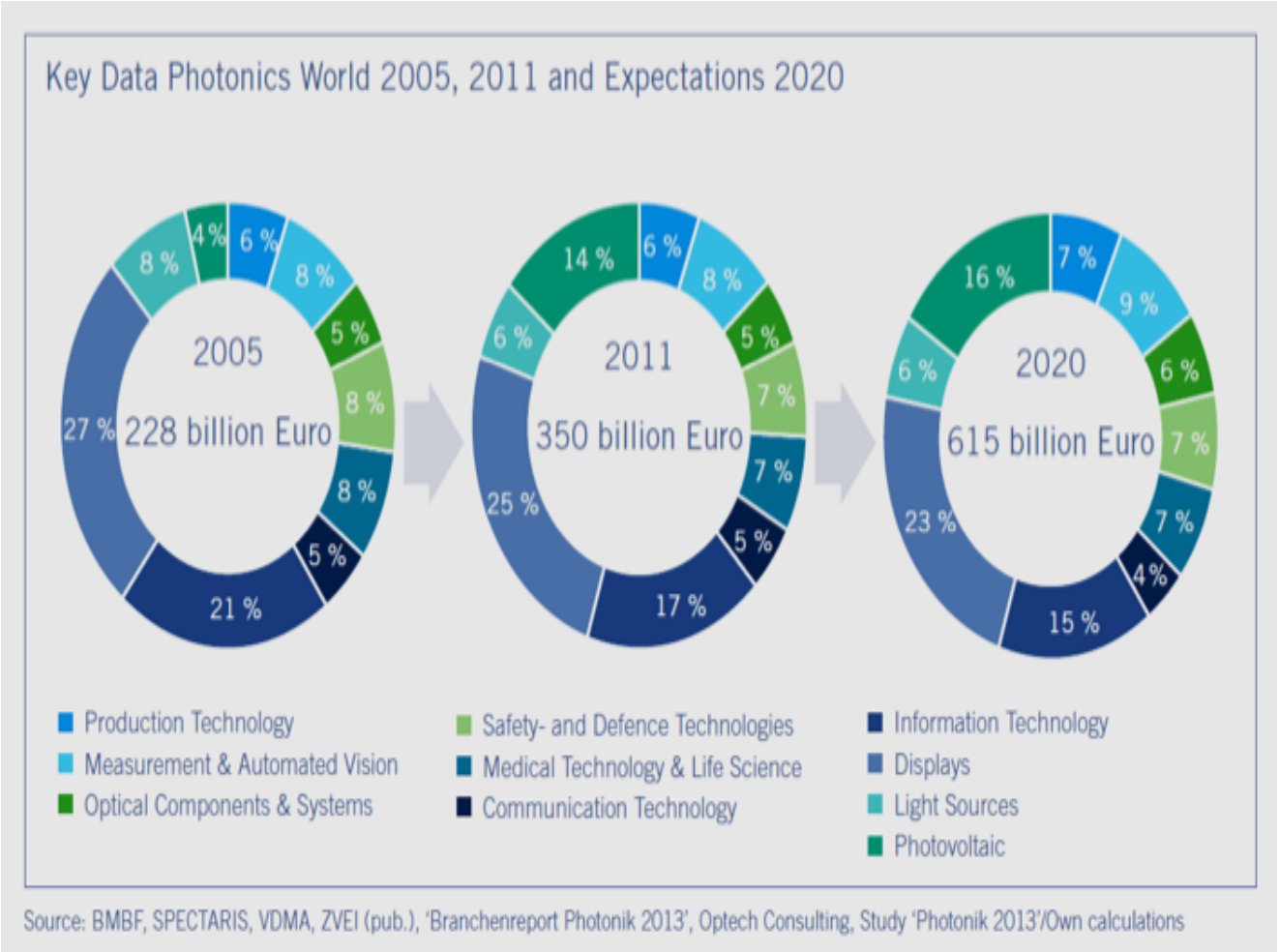
PhotonDelta

Integrated Photonics Ecosystem

Why Photonics?

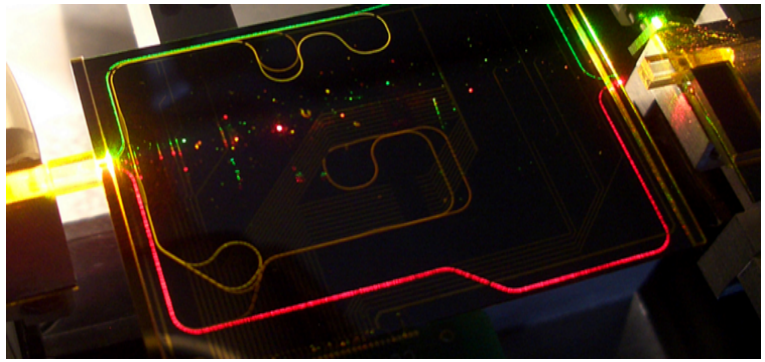
- Micro electronics approach a ceiling in achievable performance
  - Speed limitation – maximum achievable speed of CMOS based micro electronics: 100 Gb/s
  - Power consumption (pJ/bit) – telecom and datacommunication infrastructure at this moment already consume 3% of total electrical power
- Photonics enable future performance requirements
  - 2015: micro electronics technology realizes 50 Gb/s/channel
  - 2015: Photonics technology based demonstrator realizes 255 Tb/s/fiber
  - 2020: Market demands 1 Tb/s/channel
- Photonics technologies enable disruptive solutions
  - Telecommunication and datacommunication show exponential growth since 1990 (growth rate: 1.8/year)
  - Health, automotive, industry, internet of things, machine-to-machine communication, 5G network, …

Photonic revolution in micro electronics industry



Photonic revolution in micro electronics industry

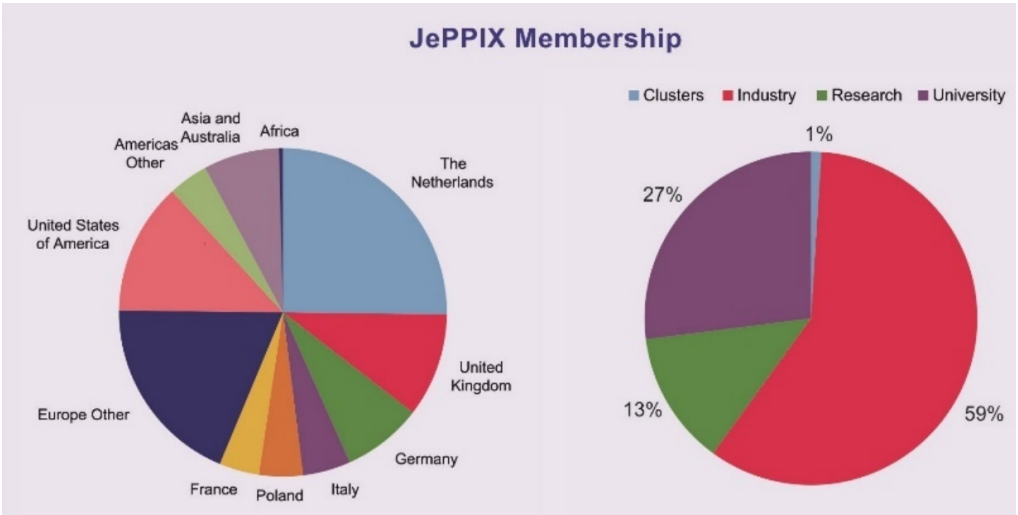
- Integrated photonics will replace/join electronic devices and systems at demanding niches
- Starting with telco and datacom industry
- Estimated total global economic value of Photonics: >€ 600 billion by 2020
- 35% of current IC market size
- Involvement of whole supply chain
- New production methods
- New businesses
- Strong R&D industry – science cooperation



Europe leads in InP Integrated Photonics

JePPIX consortium

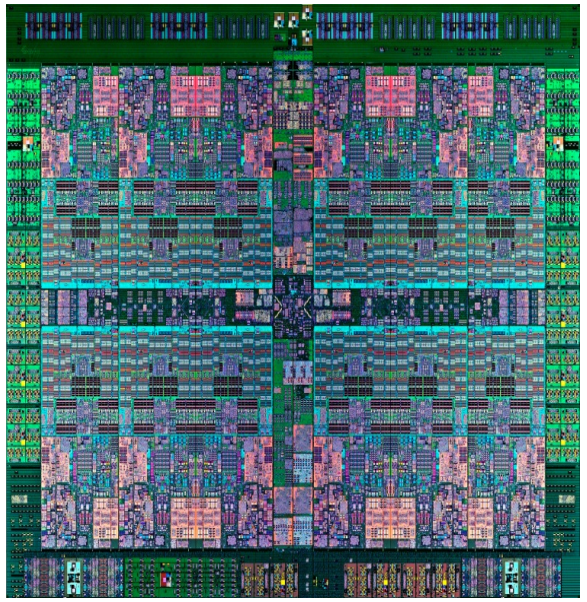
- An open collaborative network of 250 members, led by TU/e.
- Brokers between European research institutes, foundries & companies active in InP/Triplex integrated photonics
- 250+ different Photonic ICs realized so far
- Active roadmap: *The road to a multi-billion Euro market in Integrated Photonics.*



PhotonDelta
Integrated Photonics Ecosystem

What is Photonics?

First Transistor

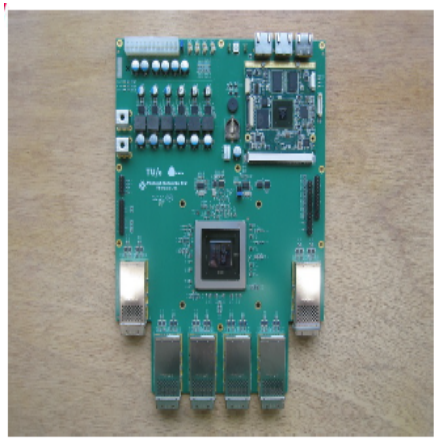


Micro electronic device

Photonics technologies are technologies that make use of photons as basic carriers of energy or information

First solid state laser

- Electronics technologies are the technologies that use electrons as basic carriers of energy or information
- Photons can be used to excite electrons and carry over (part of) their energy to electrons to bring electrons to a higher state of energy.
- Electrons can take a lower state of energy and transmit the exhaust energy as a photon.



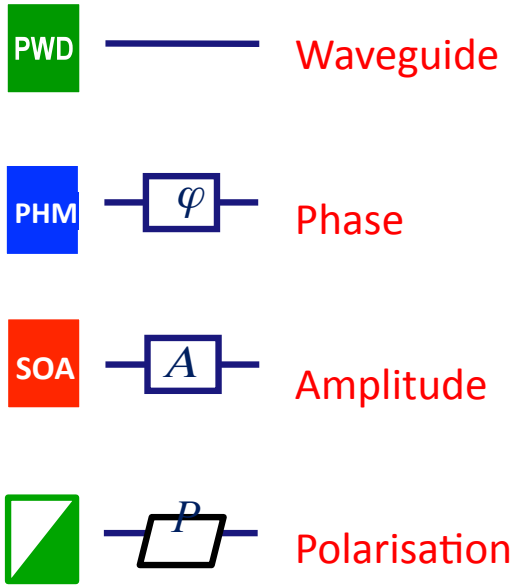
Low energy terabit switch from PhotonX Networks

What is Photonics?

State-of-the-art Photonics systems developments are based on joint contributions stemming from three main areas of expertise

- Materials (Paul Koenraad, Andrea Fiore, Erwin Kessels, Ageeth Bol, Bert Koopmans cs)
  - III-V materials (InP and GaAs) - enable production of active and passive photonic components
  - Si - restricts to production of passive components only
- Devices (Kevin Williams, Meint Smit, Mike Wale cs)
  - Integration of circuits on a single chip to achieve intended functionalities based on a limited set of well selected basic components
  - Component Library for integrated circuit design
  - Scalability and reliability of devices
- Systems (Ton Koonen, Antonio Liotta, Sonia Heemstra-de Groot, Ignas Niemegeers, cs)
  - Reliably and predictably meet application demands
  - Achieve required overall systems performance
  - Integrate best of available technologies (Photonics and wireless)

Photonic integration
4 basic elements

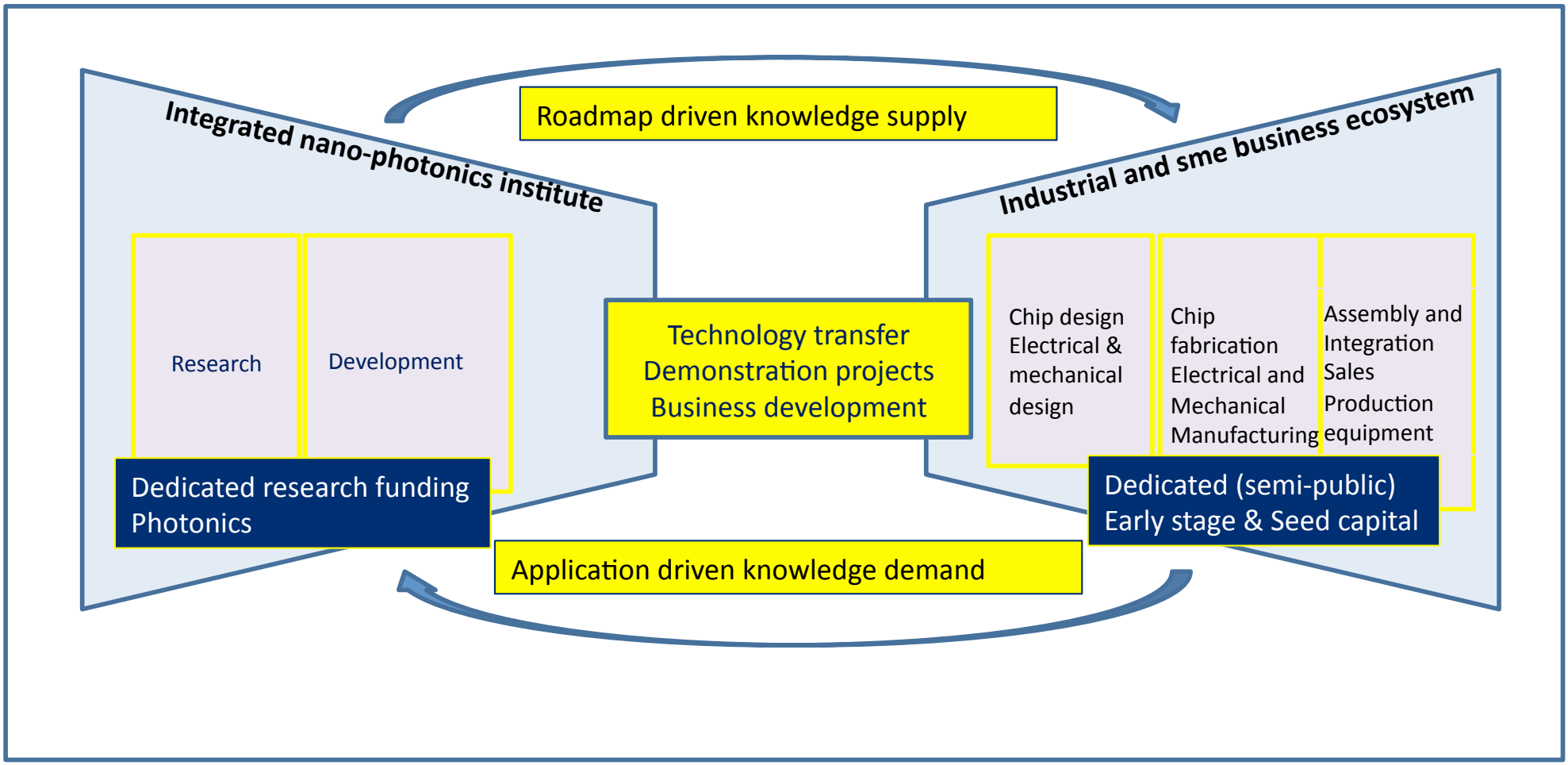


Mission and strategy Institute

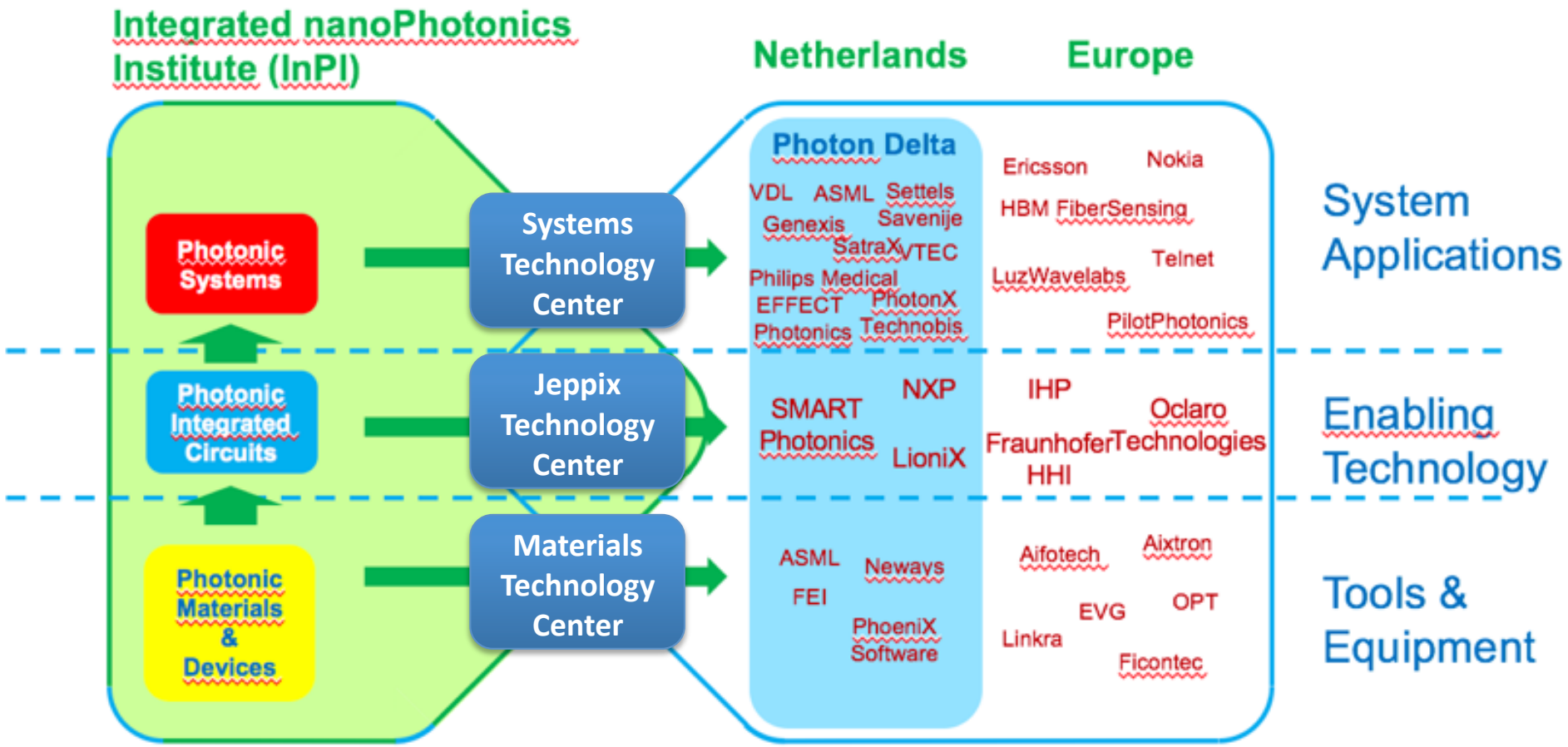
- Build, expand and leverage the research for *Photonic Materials&Devices*, *Photonic Integrated Circuits* and *Integrated Electronic-Photonic Systems* in the region
  - *Build*: involve, connect and facilitate fundamental Research & Development demand by industry and SME's towards European Institute of Nano-photonics
  - *Expand*: fundamental research on and industrial/SME innovations with integrated nano-photonics
  - *Leverage*: New business, early stage funding, R&D and scientific quality to get additional research funding, establish industrial cooperation and dedicated seed capital

PHOTON DELTA
Het fotonische ecosysteem in en rondom Eindhoven

Photon Delta Ecosystem

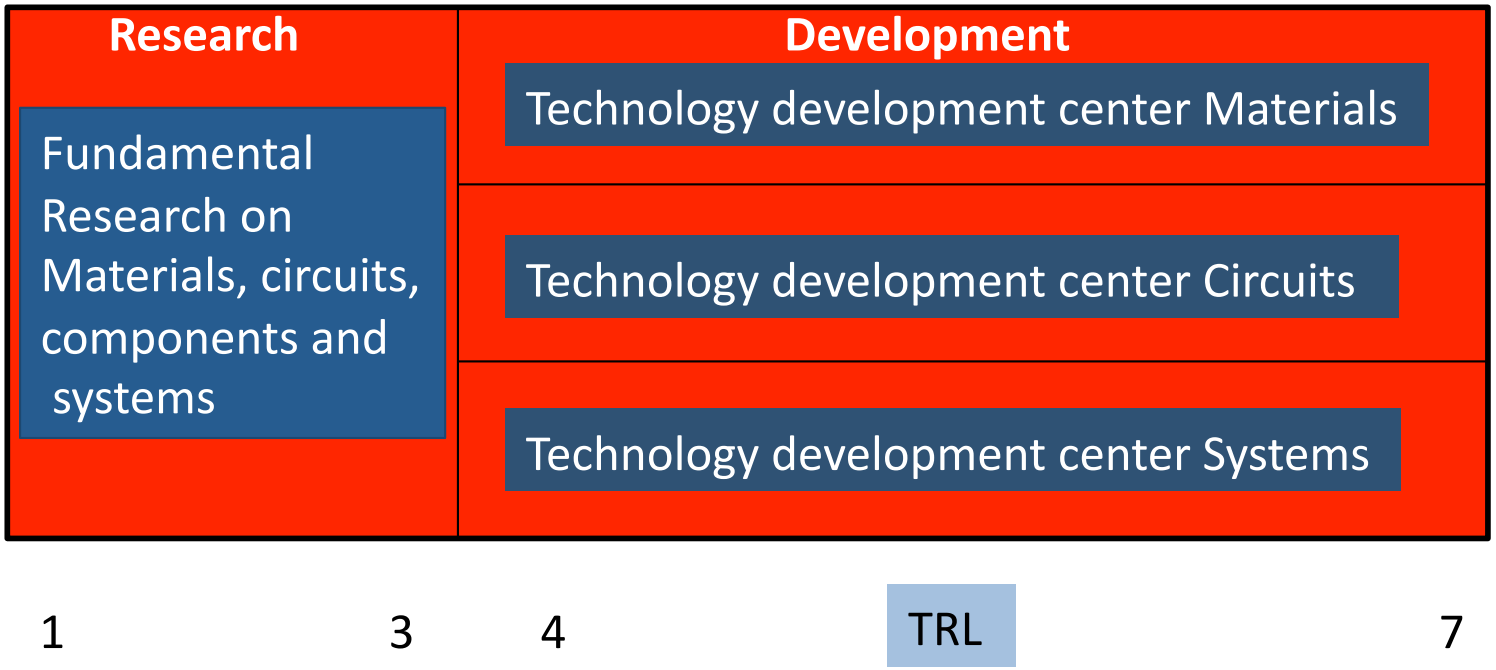


Photon Delta Ecosystem

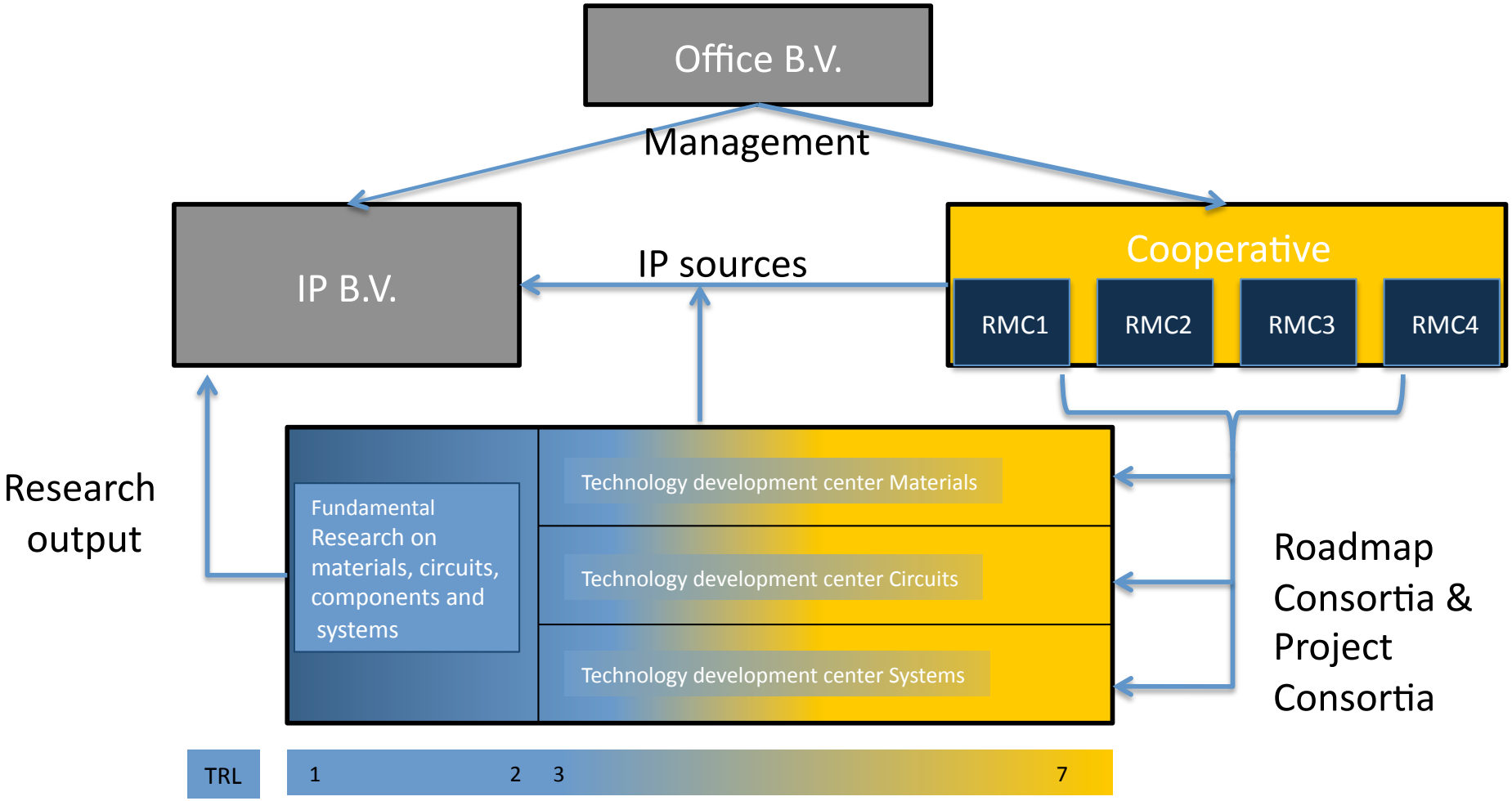


Organisatie PhotonDelta ecosysteem

Institute for Integrated Nanophotonics



Basic structure



Thank you for your attention