

Photonics21 workshop session – Photonics strategy process towards a new multiannual roadmap

Jürgen Popp and Thomas Mayerhöfer



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Overview – Workshop Agenda

First part (~ 1 ½ hours)

- Introduction and aim of the workshop
- Short Photonics PPP project input presentations for the later workshop discussion

Second part (~15 minutes)

- Short review of the previous photonics roadmap – which targets have been reached?

Third part (~3 hours)

- Workshop discussion with all participants on the major directions for the new multiannual roadmap as well as the future photonics research and innovation challenges

Lunch Break

- Continuation of the workshop discussion

Fourth part (~30 minutes)

- Presentation of the main workshop results in the plenary session after the coffee break



Overview – Workshop Agenda

09:30 – 09:35 **Welcome & Introduction**

Jürgen Popp, Photonics21 Work Group 3 Deputy Chair

Planned workshop on Performance Assessment and Standards in Biophotonics

Anna Pelagotti (European Commission)

09:35 – 11:00 **Short input presentation by the Photonics PPP projects related to life sciences and health:**

- COBIOPHAD, *Luis A. Tortajada-Genaro, Project coordinator*
- CVENT, *Peter J. Brands, Project coordinator*
- DICOMO, *Sören Steudel, Project coordinator*
- ESOTRAC, *Christian Zakian, Project coordinator*
- GALAHAD, *Alex Dudgeon, Project coordinator*
- INNODERM, *Vasilis Ntziachristos, Project coordinator*
- INSPECT, *Jean Schleipen, Project coordinator*



Overview – Workshop Agenda

09:35 – 11:00 **Short input presentation by the Photonics PPP projects related to life sciences and health:**

- LUCA, *Lorenzo Cortese, Project coordinator*
- MIRACLE, *Johannes Koeth, Project coordinator*
- MOLOKO, *Stefano Toffanin, Project coordinator*
- MOON, *Soledad Royo, Project coordinator*
- PAMMOTH, *Srirang Manohar, Project coordinator*
- PICCOLO, *Artzai Picon, Project coordinator*
- POSEIDON, *Roberto Pierobon, Project coordinator*
- SAPHELY, *Maribel Gomez, Project coordinator*
- SOLUS, *Paola Taroni, Project coordinator*

11:00 – 11:15 **Short review of the previous photonics roadmap – which targets have been reached?**

Jürgen Popp, Photonics21 Work Group 3 Chair



Overview – Workshop Agenda

11:15 – 13:00 **Discussion on the major directions for the new photonics multiannual roadmap**

All workshop participants

13:00 – 14:00 *Lunch break*

14:00 – 15:20 **Continuation of the discussion**

All workshop participants

15:20 **Next steps**

Jürgen Popp, Photonics21 Work Group 3 Chair

15:25 **Any other business**

15:30 *End of the workshop & continuation of the plenary session*



Photonics Strategy Process towards FP 9

Jürgen Popp (WG3 Chair)
Thomas Mayerhöfer



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Photonics Strategy Process towards the next Framework Programme

Mission driven approach for an EU Leadership position in photonics aiming for growth & jobs and a major contribution in solving societal and economic challenges

Task Force ✓

Annual Meeting ✓

Vision Paper ✓

Starting Today >>>

Towards #next_photonics. - Analysing Megatrends

Step 1:

Set-up a Photonics PPP Task Force Strategy to discuss our approach and process towards 2030

Decision to approach future visions for photonics by analysing Megatrends and the photonics impact

Nov. 16 – March 17

Assessing Photonics Impact on Megatrends

Step 2:

Set up Work Group Sessions at the Annual Meeting to define those Thematic Areas out of the Mega-Markets where Photonics has a large impact

March 17 – July 17

Defining Photonics Missions for FP9

Step 3:

Conducting Expert Meetings in each of those Thematic Areas to assess impact and boundaries and formulate Photonics Missions by 2030

Sept- 17 – Nov. 17

Strategic Roadmapping

Step 4:

Break Down Missions in a Strategic Multiannual Roadmap for Research and Innovation needs for Photonics in FP9

March 18 – Nov. 18



Europe's age of light – How photonics will power growth and innovation

The Photonics Vision Document

- was prepared as outcome of 8 thematic strategy workshops with the European photonics community represented by the Photonics21 Board of Stakeholders
- outlines 8 missions of the European photonics community to drive the future of Europe
- serves as input to the preparation of the new EU framework programme

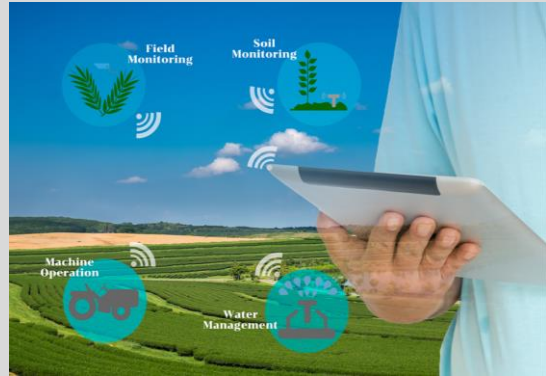


Europe's age of light – Our Vision & Missions for the next Decade

New brochure outlines how photonics will power growth and innovation



Instant diagnosis of major diseases



Quality food from farm to fork



Accident and congestions- free road transport



A truly circular economy



Photonics as a flagship science for innovation



A new quality of urban life



Empowering Industry 4.0 for a million new jobs



Zero downtime in a terabit economy



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Photonics Vision Paper for FP9: “Europe’s Age of Light”

Derived from our Mega-Markets Approach: How Photonics will power Growth and Innovation – 8 Expert Meetings defined our Missions for 2030



- **Instant diagnosis of major diseases**
fast, precise and cost effective healthcare, advanced diagnostics, pervasive monitoring and innovative e-health applications
- **Quality food from farm to fork**
push back food-borne illness and reduce environmental footprint
- **Accident and congestion-free road transport**
Multimodal transport, automated, connected and electric to maximize safety, efficiency and comfort
- **A truly circular economy**
end to depletion by managing material streams and reducing energy consumption & creating efficient industrial processes
- **A million new jobs**
revolutionize industrial production and working environments with a fully digital value chain from supplier to customer
- **10% higher productivity**
digital connectivity will create entirely quality of urban life
- **Zero downtime in a terabit economy**
making digital society work and safeguard trust, comfort and privacy by performance, resilience and security in data services
- **Photonics as a flagship science for innovation**
acting as a pillar and driver of the knowledge society playing an instrumental role in creation and dissemination of knowledge



Roadmapping Process towards FP 9 Deriving from our Missions

Our Tasks to do for the Work Group Sessions: Prioritization - Concretization – Recommendations specific to each Work Group

Prioritize Missions

Step 1:

Step 1: Prioritize the most relevant missions for our thematic workshop – Please put your dot (3 dots each workshop participant)

Define Specific Targets

Step 2: Formulate the sub-missions/targets for each of the selected missions (market data and other relevant information should be put on cards as well)

Step 3: Which Photonics R&I challenges from our area are needed to reach the identified sub-missions/targets? (market data and other relevant information should be put on cards as well)

Define Boundary Conditions

Step 4 : Which boundary conditions and additional measures will be the key for significant market impact in 2030?

Task 5 (post Annual Meeting):

Give Recommendations how to overcome the Road Blockers resp. list accelerators in order to enhance reaching the targets



Work Group Sessions for the Roadmapping Process

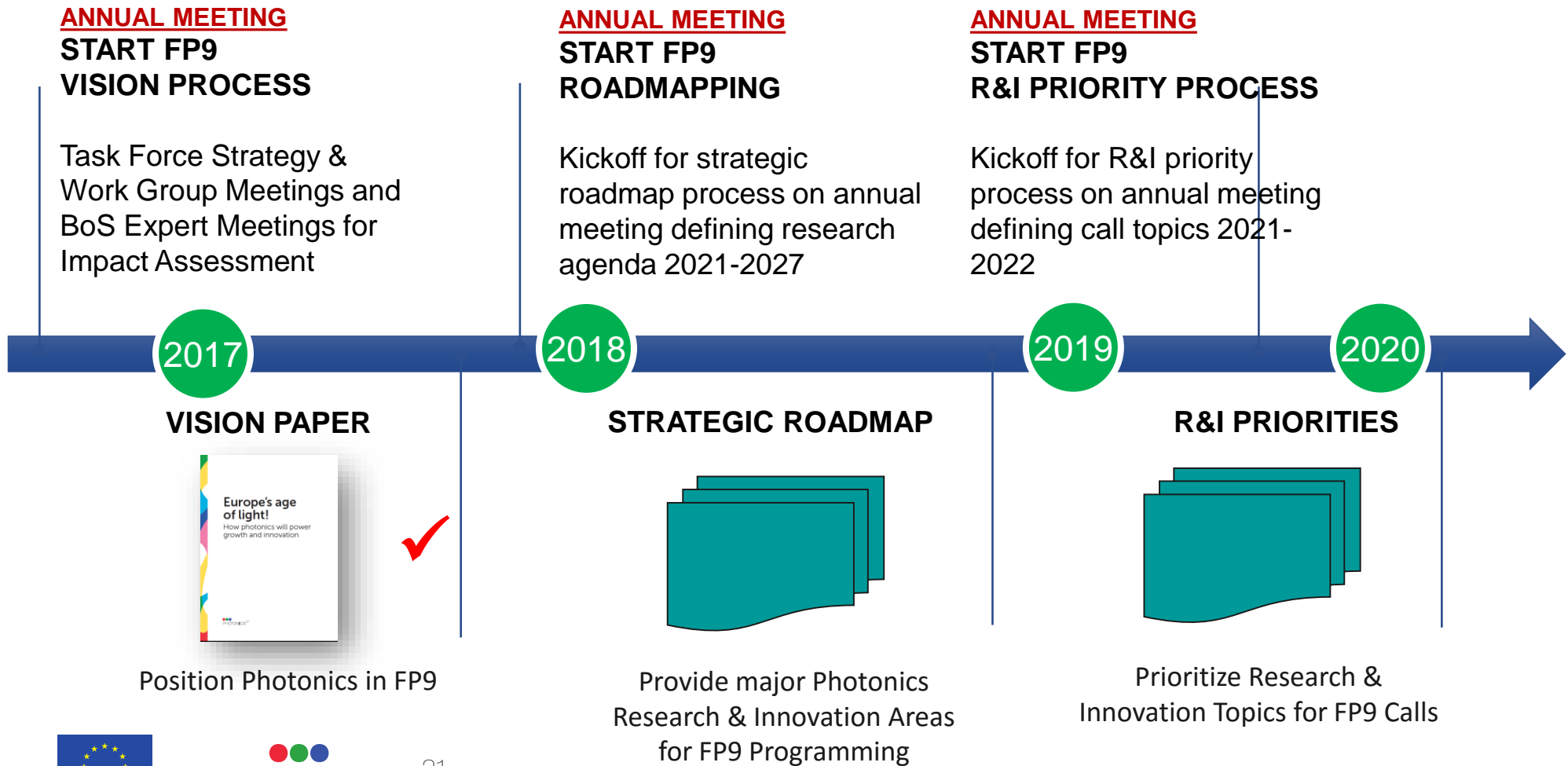
To Keep in Mind - What is critical for the our Workgroups to get to good Results

- **Start from our bold missions** to break down to your Work Group missions and targets
- Be **ambitious** in your targets – outcome must be more than “ongoing business”
- **Clear focus** and prioritization – not a bit of everything
- Focus on technologies and markets with the **largest impact** for Europe
 - on Growth
 - on Jobs
 - on solving societal and economic challenges
- List positive and negative boundary conditions - **no camouflage**
- Come up with **clear and operational** measures and recommendations



Timing of our Photonics PPP Strategic Process towards FP9

Multi-Annual Strategic Roadmap to be handed over to Commission in the frame of the Annual Meeting 2019



Review of the photonics roadmap 2014 – 2020 – which targets have been reached?

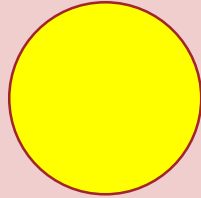
Jürgen Popp



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Workshop Life Sciences & Health

Photonics R&I Actions until 2020	Targets have been reached
<p>Photonic based mobile point-of-care devices with huge user friendliness and the following specifications: High sensitivity, specificity and accuracy, with high reliability and speed; Robustness; Safe to operate; Low cost; Compliant with regulations</p>	
<p>New and innovative multiband photonic and spectroscopic imaging methods and devices using multimodal approaches, that are either label-free or based on already safety-approved labels to further analyze age and life-style related diseases like cancer, cardiovascular and eye diseases and various neuro-pathologies</p>	<p>Projects just started</p>
<p>Photonics-based highly targeted therapies and continuous monitoring of therapeutic success (also based on other therapeutic approaches)</p>	<p>Start: 2019</p>
<p>Next generation of Biophotonics methods and tools to understand the origin of diseases</p>	<p>Start: 2020</p>
<p>Next generation photonic based analytical devices for environmental/food quality and safety applications with following specifications: High sensitivity, specificity and accuracy with high reliability and speed; Robustness; Safe and easy to operate; Low Cost</p>	<p>Combined with WG 5, start: 2020</p>

Workshop Life Sciences & Health

Photonics R&I Actions until 2020	Targets have been reached
Pilot lines for advanced optical medical devices – in-vivo diagnostics	Start: 2020
Pilot lines for advanced optical medical devices – in-vitro diagnostics	Not retained



Discussion on the major directions for the new photonics multiannual roadmap

All workshop participants



Workshop discussion – main question and steps

Which photonics R&I challenges and which boundary conditions as well as additional measures will be the key for significant market impact in 2030?

We will now proceed in **4 steps**:

Step 1.) Review the missions of the Photonics21 vision paper and prioritize the 3 most important missions for our thematic workshop area

Step 2.) Define, sort and prioritise the sub-missions/targets for each of the selected missions

Step 3.) Define, sort and prioritise the photonics R&I challenges to reach the targets

Step 4.) Define, sort and prioritise respective boundary conditions

For each step the workshop participants could work on their own or in small teams.



Step 1: Prioritize the most relevant missions for our thematic workshop – Please put your dot (3 dots each workshop participant)

European leadership in photonics will deliver these benefits in 2030:	Dots	Priority
<p>Live longer, feel better: Instant diagnosis of major diseases Fast, precise and cost-effective healthcare, advanced diagnostics, pervasive monitoring and innovative e-health applications</p>		
<p>Feed the world: Quality food from farm to fork Push back food-born illness and reduce environmental footprint</p>		
<p>Keep our traffic flowing: Accident and congestion-free road transport Multimodal transport, automated, connected and electric to maximize safety, efficiency and comfort</p>		
<p>Zero emission, less waste: A truly circular economy End depletion by managing material streams and reducing energy consumption & creating efficient industrial processes</p>		
<p>Empowering Industry 4.0: A million new jobs Revolutionize industrial production and working environments with a fully digital value chain from supplier to customer</p>		
<p>A new quality of urban life: 10% higher productivity Digital connectivity will create entirely quality of urban life</p>		
<p>Building our digital society: Zero downtime in a terabit economy Make digital society work and safeguard trust, comfort and privacy by performance, resilience and security in data services</p>		
<p>Linking big ideas: Photonics as a flagship science for innovation Act as a pillar and driver of the knowledge society playing an instrumental role in creation and dissemination of knowledge</p>		

Step 1a: Prioritize the most relevant missions for our thematic workshop – Please put your dot (3 dots each workshop participant)

European leadership in photonics will deliver these benefits in 2030:	Dots	Priority
<p>1. Mobile photonics devices for early and instant point-of-care diagnostics and treatment will increase speed, raise survival rates, reduce cost and improve efficiency</p>	31	1
<p>2. Advanced biosensors ("lab on a chip") will boost analytics and help control the spread of pandemics.</p>	20	4
<p>3. Photonics-based diagnostics to monitor and assess treatment response will open the door to the practical implementation of personalised medicine.</p>	31	1
<p>4. Photonics technology from other industrial sectors is seeing applications in healthcare as well. One innovation under development is the laser vibrometer for the detection of heart disease. Another is the 3D printing of implants such as synthetic bones.</p>	8	6
<p>5. Robotics is being combined with photonics in assisted and automated minimally invasive surgery.</p>	6	7
<p>6. Augmented-reality surgery visors superimpose data and x-ray images onto the surgeon's field of vision, raising the efficiency and precision of the surgery process.</p>	3	8
<p>7. Wearable devices – for example, photonic fibres woven into smart clothing that measures the wearer's medical condition and wellness.</p>	22	3
<p>8. "big data" analytics to speed up medical findings and clinical research, as well as administrative processes and services innovations. This shift will be enabled by a combination of ubiquitous sensor technology and high-speed fibre optics.</p>	10	5

Step 2: Define, sort and prioritise the sub-missions/targets for each of the selected missions (market data and other relevant information should be put on cards as well)

Sub-missions/Targets to reach the identified missions

Last time:

Point-of-care, multiband imaging, pilot actions:

- High sensitivity, specificity and accuracy, with high reliability and speed
- Robustness
- Safe to operate
- Compliant with regulations
- Low cost (only POC)

Future Roadmap:

- more concrete
- more explicit and
- more quantitative

e.g. reducing the diameter of endoscopes from 8 to 4 mm, providing the results of an examination instantly instead after 12 h etc.



Step 2: Define, sort and prioritise the sub-missions/targets for each of the selected missions (market data and other relevant information should be put on cards as well)

Sub-missions/Targets to reach the identified missions

- 1. Mobile/wearable photonics devices and advanced biosensors for instant point-of-care (-use) detection/diagnostics and treatment**, that measure the wearer's medical condition and wellness, wearables for monitoring environmental parameters (26 votes)
- 2. Photonic tools for life science industry as well as endusers** (e.g. medical doctors, research) (25 votes)
 - Photonic tools for real time proteomics, genomics, metabolomics.
 - Accelerating and enabling photonic tools for pharmaceutical industry, understanding, regenerative medicine, personalized medicine, high throughput high content screening
 - Photonic tools for understanding the origin of diseases beyond risk factors, finding pathways for treatment, photonics for health (nutrition, life style, environmental influences, toxicity)
- 3. Affordable photonics-based real time diagnostics** to stratify and classify disease status, monitor and assess treatment response will open the door to the practical implementation of precision medicine. **Optogenetics for treatment** of brain, heart diseases etc.; **Photonics for Physiological treatment**. Photonics for **interventional guidance** (Augmented reality). Multiscale access to the body (depth of penetration/optical resolution) (24 votes)



Step 2: Define, sort and prioritise the sub-missions/targets for each of the selected missions (market data and other relevant information should be put on cards as well)

Sub-missions/Targets to reach the identified missions

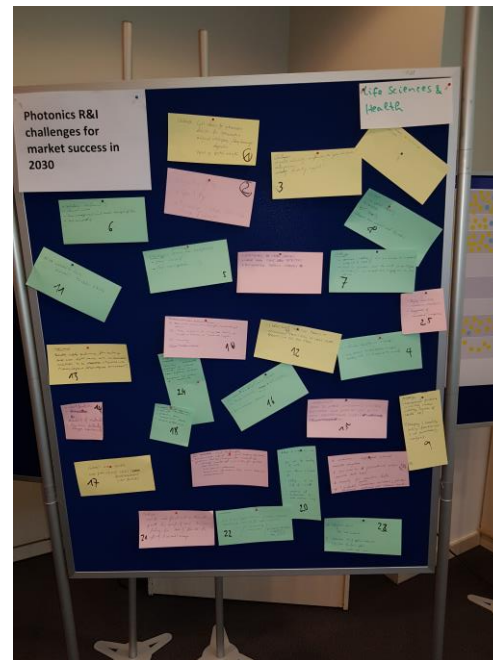
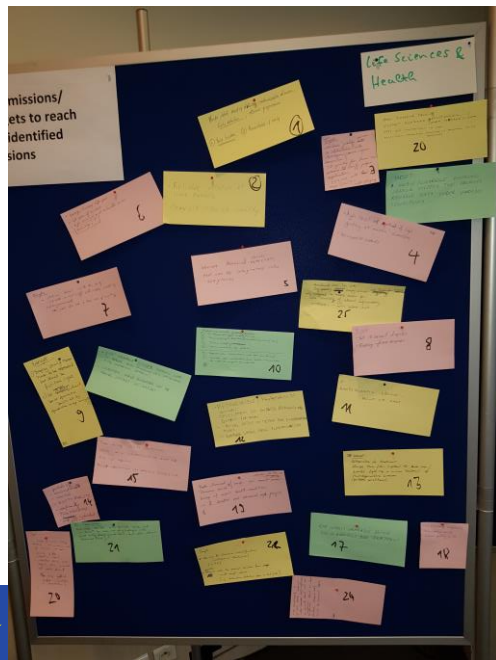
4. Biodegradable Photonic Tools (10 votes)
 5. Lighting for operating theatres, hospitals in general, general understanding of the effect of lighting on humans (1 vote)
 6. Process automatization in hospitals, work flow optimization by photonics (3 votes)
 7. Photonics for medical education (0 votes)
- “vertical issues”: Augmented reality, standardization, big data (data processing, AI, data mining)



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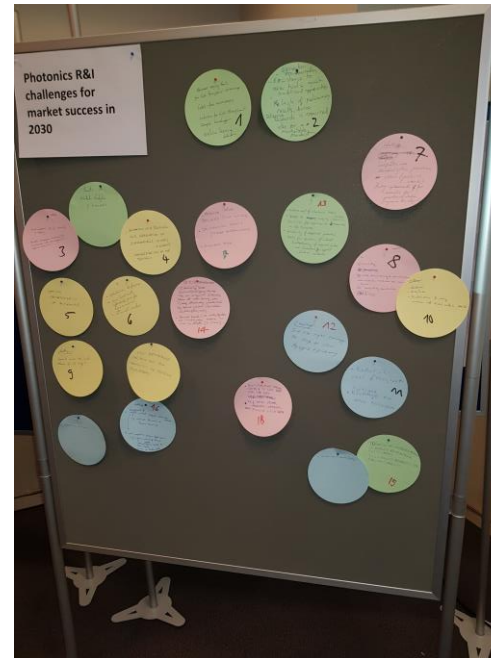
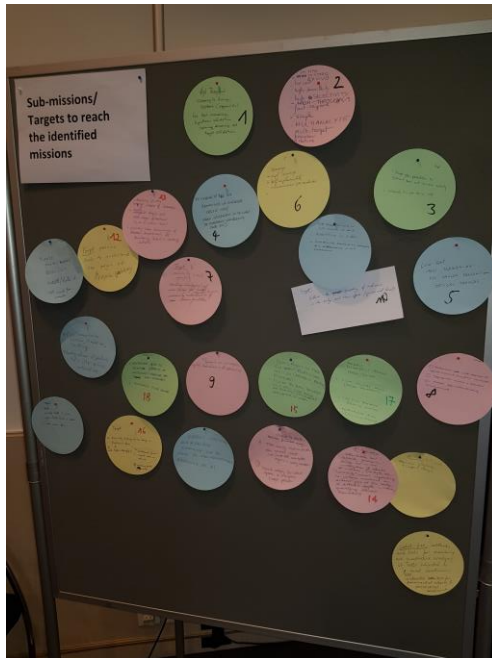
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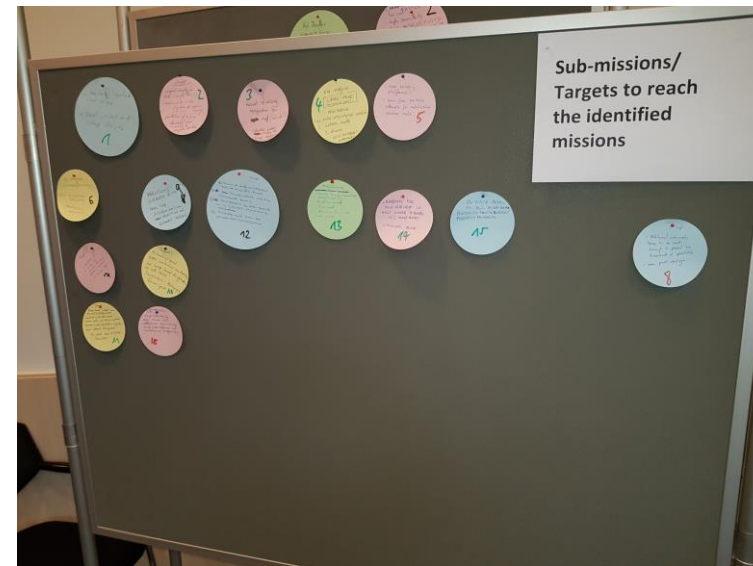
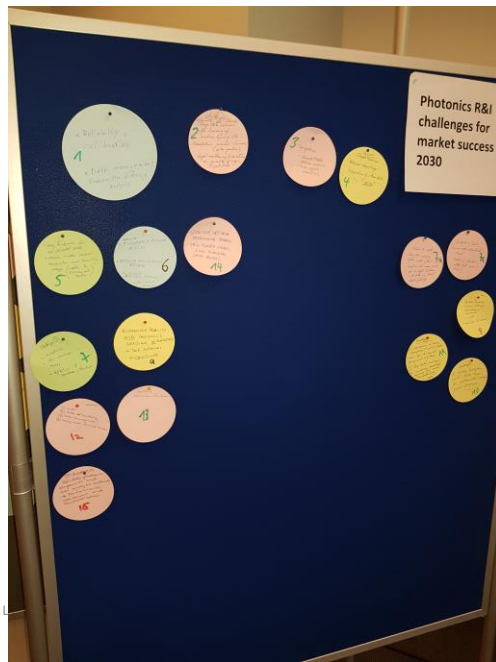
2. Photonic tools for life science industry as well as endusers (e.g. medical doctors, research) (25 votes)



Step 2: Define, sort and prioritise the sub-missions/targets for each of the selected missions (market data and other relevant information should be put on cards as well)

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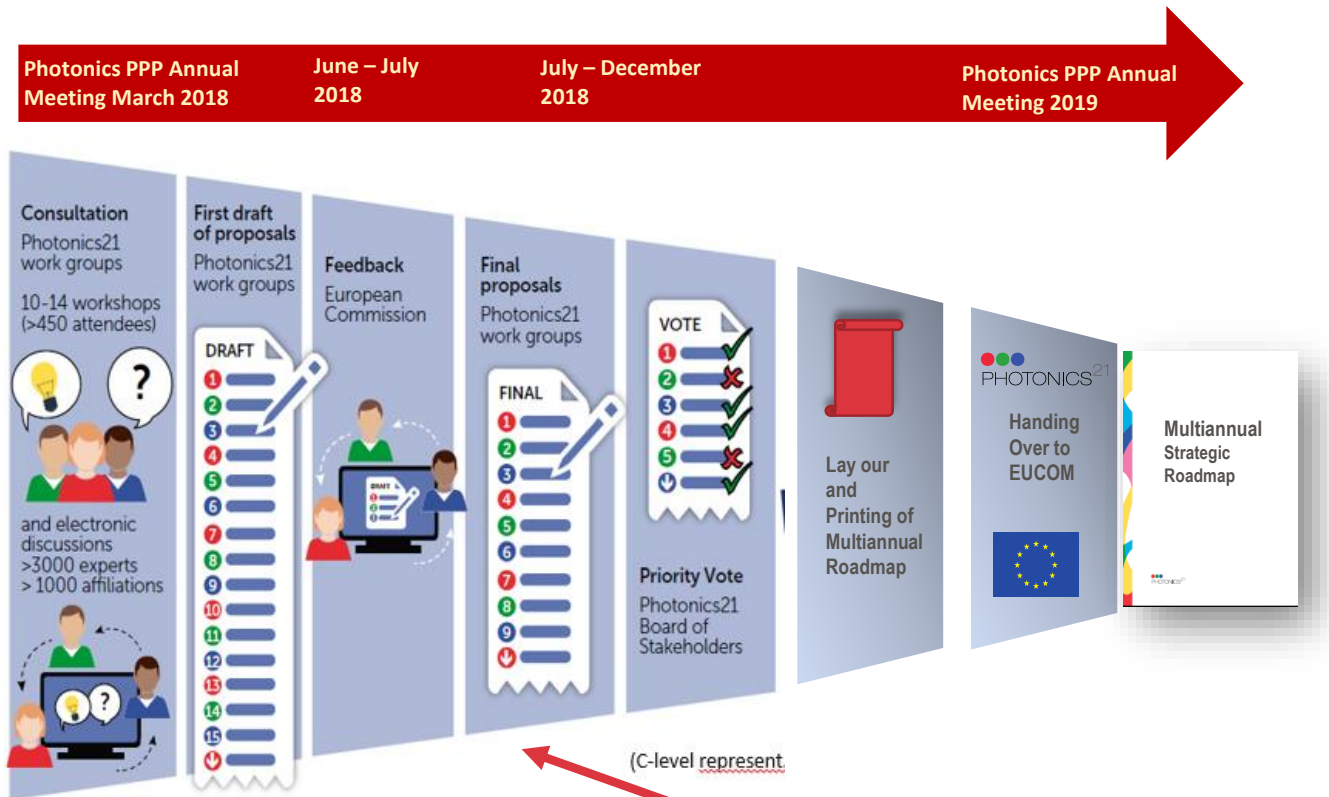


Next steps

Jürgen Popp



Photonics21 Strategic Research and Innovation Agenda Process towards FP9 – Standard Process applied



2nd Workshop:
Thursday, July 5th,
Berlin, Leibniz-
Geschäftsstelle

