

TECHNOLOGY TRENDS: HOW RESEARCH & TECHNOLOGY ORGANISATIONS SEE THE OPPORTUNITIES AND CHALLENGES FOR EUROPE

Summary of the main conclusions gathered from
»The RTO Innovation Summit«, 06.-07.11.2018, Brussels

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How to create impact through research?

At The RTO Innovation Summit in Brussels on 6-7 November, ten leading European Research and Technology Organizations (RTOs) presented their vision and roadmap for Horizon Europe, explained how applied research will contribute to the competitiveness of industry and discussed how to best tackle Europe's biggest challenges in the coming years. More than 100 top technology experts discussed in 15 thematic workshops about the future direction of their fields – and how Europe can benefit.

»The RTO Innovation Summit« was the first event of its kind organized jointly by ten European Research and Technology Organizations (RTOs): hosted by Fraunhofer-Gesellschaft in cooperation with AIT, CEA Tech, DTI, imec, RISE, SINTEF, TECNALIA, TNO and VTT. The Summit took place against the background of the ongoing preparations for the future EU research framework program »Horizon Europe«. The Research and Technology Organization is a remarkable European model for bringing ideas to market. RTOs are specialized R&D institutions that solve technical problems and develop new products and services for industry, government and others.

In his contribution, Jyrki Katainen, Vice-President of the European Commission for Employment, Growth, Investment and Competitiveness, emphasized that the transfer of research results from science to industry in Europe must be improved and that RTOs play an important role in this.

Professor Neugebauer, President of the Fraunhofer-Gesellschaft, Europe's largest research organization, underlined that a successful transfer of research results requires appropriate framework conditions. Horizon Europe could offer excellent opportunities to decisively foster Europe's innovative strength if the right priorities are set. He advocated clear priorities for research topics that promote innovation and have an impact on Europe, such as de-carbonization of our industry and our energy system. Professor Neugebauer stressed that in the light of the enormous challenges Europe is facing -such as Brexit and tight public budgets- it is not enough to demand more money for basic research. Instead we have to work together and we need to ensure the valorization of research results.

Peter Frans Pauwels, co-founder of TomTom, took the audience back to the start of TomTom and shared his experience and lessons learned about his journey from start-up to global player. Determination, pace and some luck along the way are the ingredients of TomTom's exceptional success that was entirely build on cutting-edge technology. He stressed that it is important for him and industry to be at The RTO Innovation Summit to have that conversation with RTOs about trends and technologies and to learn from each other.

What follows is a summary of the main conclusions from the series of 15 workshops focusing on the five clusters of the »Global Challenges and Industrial Competitiveness« pillar of Horizon Europe.

Smart (Urban) Mobility

Tomorrow's mobility of persons and goods will look different from today's – we need to cope with infrastructure from the 20th century and requirements from the 21st century. The biggest challenge will be to decrease CO₂ emissions by 54% until 2050 whereas at the same time emissions from transport are expected to increase by around 70%. Truly new mobility concepts are needed that do not just replace individual technologies but also include electrification from sustainable sources and data protection as a priority. An important question in this regard is how to define the word »smart«: Is it about efficiency, connectivity, quality of life or sustainability?

RTOs play an important role by developing solutions such as autonomous driving, electrification and transport concepts, but also in evaluating them from a life cycle perspective. Nevertheless, it is also a question of the right framework conditions as most companies and customers will opt for cheaper alternatives where sustainable solutions and products are more expensive than non-sustainable ones.

Renewable Energy & Storage

Europe is in an energy and climate transition towards a zero emission society which at the same time provides an immense opportunity when we look at the innovation system perspective. There is great awareness of the upcoming challenges such as future energy grids, standards and protocols for flexible, industrial demand side services and a stronger integration of energy system analysis across sectors.

Efforts for handling these challenges are being made both among industrial stakeholders and among researchers – RTOs serve here as mediator between science and industry and contribute strongly to the transition themselves. However, Europe must ramp up energy R&I and secure key technology assets to ensure the transition, capitalize on investments and to take full advantage of some of the world's largest business themes such as energy efficiency and clean energy.

De-Carbonization of industrial processes

A major hurdle with the necessary de-carbonization of Europe's industries is that companies face global competition and large, risky investments. Different industrial sectors such as steel, oil, chemical & bio-based, paper & pulp, cement & lime and glass & ceramics as well as companies integrating renewable energies into their industrial processes are all facing similar challenges.

During the session, approaches to both avoiding and using CO₂ were presented by the RTOs. However, the panelists agreed that in order to demonstrate the ability of those advanced technologies to be economically and ecologically viable and thus, to overcome the technological and commercial valley of death, a synergetic, powerful support for European industry and research is still necessary. Both large-scale industrial demonstration projects that can deliver significant emission reductions within 5-10 years and smaller projects for broader impact across the EU are needed. The large-scale projects should showcase the implementation of innovative technologies and demonstrate the business case to operate such low carbon industrial processes in the long-run. Industrial innovation in low-carbon technologies and processes in energy intensive sectors such as steel or cement offer the highest potential to deliver deep emission cuts.

Smart Manufacturing

In future, innovation will be tremendously facilitated by collaboration in trusted networks with stakeholders from all along the value chain. Smart Manufacturing sees that trend emerging in all three focus areas: Additive Manufacturing, Artificial Intelligence & Sensing and Machine-Human-Interaction. The constant feedback loop from real object to digital twin and back will allow real-time adjustment and optimization with major cost savings and productivity gains. Improved sensing technologies will multiply the amount of available data and greatly enhance the scope of AI in Smart Manufacturing. There lies a huge economic potential in Smart Manufacturing technologies for assistance on the shop-floor level; but to realize the profit, industry will have to invest also in professional education and strategic skill management of its blue- and white-collar workforce.

Robotics

Robotics bridges the gap between the digital and the real/physical world. In the near future, robots will play an important role in more areas than only Manufacturing: Healthcare, Agri-Food, Maintenance & Inspection of Infrastructure and Agile Production will be key applications for robotics. Robots will work alongside human beings in their professional and private environment and help them with their daily tasks. The structural change in the way we act, behave and collaborate with machines has to be accompanied by a change management process to enhance acceptance and technology adoption. In the field of robotics, RTOs work already closely aligned with industry and create real impact through technology transfer. Europe can leverage today's excellence in robotics by investing in partnerships and collaboration for innovation.

Artificial Intelligence & Cognitive Systems

The global race for leadership in AI is not decided yet. Especially in the industrial realm, Europe has a competitive advantage with its strong industrial base and its excellent R&I landscape. The US have lost their knowledge due to massive de-industrialization in the last decades and China is not on the European level yet. This gives Europe a window of opportunity to invest in AI and tackle the imminent challenges. We have to find answers to open ethical questions about Human Responsibility, Human Prejudice and Human Understanding. The availability of big data, affordable HPC, open source software and deep learning systems allows the next breakthrough leap in AI – let's seize the chance to formulate the necessary European regulation and accelerate the technological progress.

Circular Systems

After 200 years of linear economy, circular systems comprise a new concept which integrates circular economy, society and stakeholders. Waste is a resource – plastic was highlighted as one important example that it is still much needed for our modern society, but new processes for its re-use are to be developed. The world has to reduce resources by 50% from 2018 to 2030. Europe is the leader in the world in this domain, therefore further investment into research and development including new business models and enhanced cooperation with industry and the engagement of society are mandatory to keep this position. Key challenges are to lay the scientific foundations, generate know-how and create system services and structures that will open up ways to a knowledge-based circular system for society and industry.

Food Systems

The world population is growing ever faster, therefore innovative new food production is necessary. This comprises high-quality, healthy and convenient foods and ingredients, safe, customer-friendly and recyclable packaging and materials, smart farming concepts, optimized machinery, equipment and processes, as well as innovative cleaning technologies, holistic sensory optimization of raw materials and market-ready products and innovative recycling technologies, bio-based additives and environmental analysis. Novel food production techniques could include personalized food, enhancing the health of elderly consumers by using 3D printing. A key barrier to innovation is the lack of finance. An intensified collaboration with international research, development and innovation oriented organizations is required urgently to compete with other regions in the world.

Biological Transformation of Industry

Biological transformation means the increasing utilization of materials, structures and processes of living nature in technologies with the goal of sustainable added value, thus going far beyond the concept of Bioeconomy. The 2018 Nobel Prize award for Directed Evolution and Phage Display is a contribution to foster the biological transformation. Further examples were given on bio-resources (e.g. grass as source for proteins) from field to products, development of novel functional proteins and bioactive ingredients from rapeseed, olive, tomato and citrus fruit side streams for applications in food, cosmetics, pet food and adhesives. The enormous potential of microalgae production even possible under Nordic climate conditions and without arable land to feed the growing population including livestock needs further research into upscaling processes. Key challenges are value added processing of biomass, cascading utilization and connecting the sectors and companies.

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Cluster 4: Cluster Inclusive and secure society

Social Innovation

For innovations to be adopted and to realize their full potential, social needs and behaviors are often more important than just economic, political or technological aspects. We need to make sure that those affected by a technological innovation are much more involved in the innovation process. Social innovation becomes more and more important for RTOs.

Security and Protection

Within the area of security we need to facilitate and enhance the uptake of project results in the public domain – for instance for our police or fire brigade. Under Horizon Europe the systematic end-user involvement was an important step. Now we need to build on this and involve those who procure and those who take management decisions in a more effective way. This requires incentives and that security policy go hand in hand with research.

Cybersecurity

Until now cybersecurity mostly focused on making closed systems and separate components more secure. We need a paradigm shift which has two dimensions:

- 1) Europe should research security for large systems – from their individual components all the way up to their interaction within comprehensive security solutions.
- 2) We should focus on cyber resilience – meaning rather than only increasing security we need to research how to manage the damages and get our systems up and running as fast as possible.

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Cluster 5: Health

Digital solutions for health and care

The digitization of healthcare system holds great potential for the future, especially in providing better individual and cost-intelligent care. One of the major challenges is the accessibility of data. Personal health management, as an example, requires more and more data. Information can no longer be used so easily because data is produced and managed by different healthcare providers, government agencies and citizens themselves, making it difficult to search for and reuse data.

Tools and technologies for Health & Care

Medtech is a strategic sector for Europe covering a broad range of tools and technologies for health and care. Accelerating the digitization and market access of Emerging Technologies for Healthcare is a major challenge – and RTOs have a pivotal role to play. Smart health technologies heavily depend on multi Key Enabling Technologies (KETs), especially digital technologies. It's the genetic background of RTOs to develop multi-KETs

approaches for the benefit of industry. Market access of innovation in health tech should be envisaged from the early preclinical proofs of concept. RTO expertise comprises several application sectors to support companies, big or small, all along the value chain.

The issue of data protection in e-health is another big issue that needs to be solved before we can unlock the enormous potential of e-health. Patients and healthcare professionals alike need to trust the confidentiality of digital healthcare systems. The trust in digital health care will be paramount for a wider acceptance in the public.

EXTRA Topic: European
Technology Infrastructures for
applied research and industrial
innovation

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Technology infrastructures are the backbone for European innovation and competitiveness. As open environments they link together all parts of the innovation system, such as industry, academia, business developers and SMEs. Technology infrastructures give SMEs access to state-of-the-art facilities and testbeds and, in extension, engagement with larger companies. The panelists concluded that Europe needs a strategic approach to utilize the full potential of its technology infrastructures. The cross-border knowledge transfer between tech infrastructures needs to be coordinated and intensified. Access needs to be given to SMEs in regions that do not have adequate tech facilities or infrastructures for SMEs. Such a scheme should be coordinated in a European collaborative manner.

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Panel Discussion: Advancement of Deep Tech

In an animated discussion Shiva Dustdar (Head of Innovation Finance Advisory Division of the European Investment Bank), Matthias Keckl (Head of Fraunhofer Venture Lab) and Jayson Myers (CEO Next Generation Manufacturing Canada) agreed on the need to have special financing instruments for deep tech spin-offs in Europe.

The need to build capacity to manage technologies and to be able to scale up a technology for a commercial application is key for industry, especially SMEs, and RTOs can play a crucial role in there.