



**MANUFUTURE
2017, TALLINN**

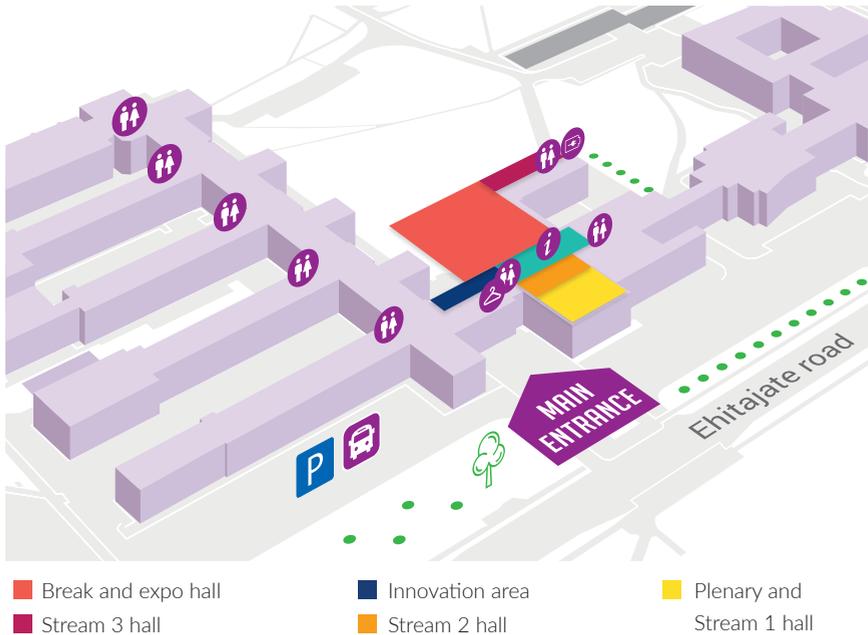
**MOVING UP
THE VALUE CHAIN**

24-25 OCTOBER, 2017
Tallinn University of Technology



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723834.





Conference takes place at TTÜ main building, address Ehitajate road 5, Tallinn.

Smart Machines Welcome Reception takes place on 23 October in a historic powerplant that used to power the whole of Tallinn. Energy Discovery Centre is located near the sea and Tallinn Old Town, address Põhja pst 29, Tallinn.

Industry 4.0 Seasons Gala Dinner takes place on 24 October in the Seaplane Harbour, which was home to Harbour that was home for seaplanes and now serves as a museum. Seaplane Harbour is located by the sea, address Vesilennuki tee 6, Tallinn.

Manufuture conferences have brought together industry leaders and engineers, university professors and researchers, decision-makers from local ministries and European Commission every second year. Estonia hosts the Manufuture 2017 under Presidency in 2017 – a perfect time for reviewing the ongoing H2020 period and planning the next framework initiatives 2021 and beyond.

Moving up the value chain is the spotlight at this conference: we are going to analyse the 4th industrial revolution in practice, discuss sustainable manufacturing and circular economy topics, share experience of collaborative technological innovation in manufacturing, and much more besides. Dear speakers and guests - welcome to Manufuture 2017!

Prof. Tauno Otto

Programme Director
Tallinn University of Technology





TALLINN UNIVERSITY OF TECHNOLOGY

Tallinn University of Technology is a modern university of technology, whose strength lies in the synergy between technological, natural, exact, social and health sciences. TTÜ is responsible for producing the next generation of engineers and advancing engineering culture in Estonia, contributing to the sustainable development of the society and increased national prosperity with its innovative services.

www.ttu.ee



EFFRA

The European Factories of the Future Research Association (EFFRA) is an industry-driven association promoting the development of new and innovative production technologies. It is the official representative of the private side of the European Union's 'Factories of the Future' research and innovation partnership.

www.effra.eu



ITL

The Estonian Association of Information Technology and Telecommunications (ITL) - your Gateway to the E-Estonia Powerhouse. ITL is an organisation, whose primary objective is to unite the Estonian information technology and telecommunications companies, promote their cooperation, represent and protect the interests and initiate new innovative business projects through Estonian ICT Cluster.

www.itl.ee/Eng



DIMECC

DIMECC Ltd. is the leading co-creation platform for digital transformation. DIMECC combines the leading companies from manufacturing and digital industries industries in academic research. DIMECC's customers outperformed the non-customers from respective industries during 2009-2014 by all financial measures. Where leaders and winners meet – DIMECC.

www.dimecc.com



Innovative Manufacturing Engineering
Systems Competence Centre

IMECC

IMECC OÜ is a high-tech consortium owned by several Estonian industrial companies and Tallinn University of Technology as science partner. IMECC's main activities are research and development in the fields of digital manufacturing, process automation and robotics, mechatronics, materials' technology. IMECC manages and participates in several national and international projects and offers several different services to companies.

www.imecc.ee/en



Innovate UK works with people, companies and partner organisations to find and drive the science and technology innovations that will grow the UK economy. With a strong business focus, Innovate UK drives growth by working with companies to de-risk, enable and support innovation, and funds a variety of organisations to help in this work, including Enterprise Europe Network, Knowledge Transfer Network, and Catapult centres.

www.gov.uk/government/organisations/innovate-uk



EUROPEAN COMMISSION

The European Commission is represented by the Industrial Technologies Directorate of DG Research & Innovation. Our mission is to support the renaissance of European high added value manufacturing through innovation-based growth thereby contributing to job creation and reinforcing European leadership in the global context. A team of dedicated staff is present on the European Commission stand to answer your questions about the funding possibilities in Horizon 2020, proposal submission, consortium building, etc.

www.ec.europa.eu



AHK

The German-Baltic Chamber of Commerce in Estonia, Latvia, Lithuania (AHK) serves as a network platform for business contacts and offers an extensive range of commercial services, market research, information and advice. Within its three offices in Tallinn, Riga and Vilnius the Chamber represents the interests of its 470 members.

www.ahk-balt.org



ESTONIAN ELECTRONICS INDUSTRIES ASSOCIATION

Estonian Electronics Industries Association is a voluntary non-profit organisation that aims to increase the competitiveness of the Estonian electronics industry. The Association's 50 member companies cover all aspects of electronics value chain from supplies, training and product development to manufacturing and aftersales. The Association – export cluster for smart electronics.

www.estonianelectronics.eu



GERMAN EMBASSY

The German Embassy in Tallinn is the official representation of the Federal Republic of Germany in Estonia. Close cooperation with the Estonian Government and Parliament, the business, cultural and media worlds as well as with Estonia's civil society are essential to the Embassy's mission of furthering partnership and friendship between Germany and Estonia and its peoples, bilaterally as well as in the European Union, NATO and the OSCE. Since September 2015, Christoph Eichhorn is Germany's Ambassador to Estonia.

www.tallinn.diplo.de



ENTERPRISE ESTONIA

Enterprise Estonia (EAS) contributes to the achievement of long-term strategic goals of the Estonian economy. EAS promotes business and regional policy in Estonia and is one of the largest institutions within the national support system for entrepreneurship by providing financial assistance, counselling, cooperation opportunities for foreign investments and training for entrepreneurs, research institutions, the public and non-profit sectors.

www.eas.ee

www.investinestonia.com



EML

Federation of Estonian Engineering Industry is a non-profit organisation with members such as machine building and metal companies and different education organizations. Our members range from Estonia's biggest and oldest companies to small and flexible companies and also educational organizations, including vocational schools.

www.emliit.ee



TELIA

Telia Estonia is a new generation IT and telecommunications company and is a part of the international group Telia Company. Telia offers a wide range of integrated mobile, broadband, TV, and IT solutions, as well as valuable content to both residential and business customers. The mission of Telia Estonia is to make Estonia a better place to live and work in.

www.telia.ee



ABB

ABB is a pioneering technology leader that is writing the future of industrial digitalisation. For more than four decades, we have been at the forefront, innovating digitally connected and enabled industrial equipment and systems. Every day, we drive efficiency, safety and productivity in utilities, industry, transport and infrastructure globally.

www.abb.com



FUJITSU

Fujitsu is the leading Japanese information and communication technology (ICT) company, offering a full range of technology products, solutions, and services. Approximately 155,000 Fujitsu people support customers in more than 100 countries. We use our experience and the power of ICT to shape the future of society with our customers.

www.fujitsu.com



HELMES

Helmes is an international software development house with 260+ experts, more than 25 years of experience. We focus on design and development of software solutions critical for the operation of the business – to help create automated and efficient processes. For industry we can create more transparent process control and data flow between ERP and shop-floor data.

www.helmes.com



NORTAL

Nortal is a multinational strategic change and technology company. Combining the unique experience of transforming Estonia into a digital leader and creating change in businesses with a strategic approach and data-driven technology, our vision is to build a seamless society.

www.nortal.com



Ingenuity for life

SIEMENS

Siemens creates benefits for customers and society through electrification, automation and digitalisation. The open, cloud-based IoT operating system, MindSphere, connects machines and physical infrastructure to the digital world. It helps to transform big data into concrete answers to the most urgent challenges. Siemens helps to improve quality of life and create lasting value for the digital society.

www.siemens.com

www.siemens.com/digitalisation

www.siemens.com/mindsphere



Baden-Württemberg International

BADEN-WÜRTTEMBERG INTERNATIONAL

Baden-Württemberg International is the agency for international economic and scientific cooperation of the federal state of Baden-Württemberg in Germany. We lend support to domestic and foreign companies, research institutions and universities in all questions relating to internationalisation. Baden-Württemberg is a strong innovation and industrial location and a leader in industry 4.0.

www.bw-i.de/en
www.bw-invest.de



EIT RAWMATERIALS

EIT RawMaterials is an innovation community within the metals and minerals sector. The community is built out of 116 European partners – industrial companies, universities and research institutions. EIT RawMaterials funds collaborative projects to get closer to the markets across the value chain from exploration, mining and minerals processing to substitution, recycling and design for circular economy.

www.eitrawmaterials.eu



SIMPLAN AG

SimPlan AG is focused on process improvement technologies for manufacturing, logistics, and transportation. SimPlan offers simulation studies, simulation software, MES software, support and consultancy in all industries. As SME with 65 employees, we develop software and participate in European research projects. There is knowledge in simulation, virtual commissioning, and optimization.

www.simplan.de



ENEFIT

The biggest energy company in Estonia, Enefit/Eesti Enregia is transforming from an old-school utility to a client-oriented IT enterprise. We increase efficiency through digitalisation and data-based management. Our digitalisation process – e-Energy – enables flexible data handling providing higher efficiency and competitiveness. For us, e-Energy is the way of lifestyle and we are ready to share our experience with partners.

www.energia.ee/e-energy



PROGRAMME

MONDAY 23 October 2017

19:00 – 21:00 **Smart Machines Welcome Reception at the Energy Discovery Centre**

TUESDAY 24 October 2017

8:30 – 9:30 **Registration**

9:30 – 9:40 ● **Conference opening by Chairperson of the Conference**
Karen Coleman, Broadcaster, Journalist & Author

9:40 – 10:15 **Keynote speeches**

- **Opening of the Presidency Event Manufuture 2017**
Kersti Kaljulaid, President of the Republic of Estonia
- **Video greeting by Carlos Moedas**
EU Commissioner of Research, Science and Innovation
- **e-Estonia Success Story**
Academician Jaak Aaviksoo, Rector, Tallinn University of Technology

10:15 – 11:15 **Plenary Session 1: Competitiveness and Sustainability of European Manufacturing, incl. Digitalisation**

- **Moving up the Value Chain – ManuFuture 2030: Strategic Vision**
Prof. Dr.-Ing. Heinrich Flegel, Chairman, ManuFuture High Level Group
- **Realising Europe's Industrial Potential**
Maurizio Gattiglio, Chairman, EFFRA
- **EU Industrial Policy Strategy: Investing in a Smart, Innovative and Sustainable Industry**
Lowri Evans, Director-General of the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, European Commission

11:15 – 11:45 **Networking break and Partner presentation**

- **Capturing Silent Knowledge of Machine Whisperers**
Ergin Tuganay, Partner & Head of Industry 4.0, Nortal Oy

11:45 – 13:15

**Stream 1:
Industry 4.0 in Practice**

**Digital Manufacturing:
Advancing the Digitalisation
of European Industry**

Chairperson Karen Coleman

- **Becoming a Digital Industrial Company – the Brilliant Factory Initiative**
Claudio Kantner, Brilliant Factory Leader, GE Power
- **Turning Ideas into Reality: The Journey of One Leading Manufacturer into the Industrial IoT**
Hans Michael Krause, Director Market and Product Management PLC and IoT, Bosch Rexroth AG
- **Has Europe Lost the B2C Revolution & Will Europe Be the Winner of the B2B Digital Industrial Revolution?**
Cecilia Bonefeld-Dahl, Director General, DIGITALEUROPE
- **Industry 4.0 – Where to Go**
Joost van Iersel, President of the ECO Section, EESC

**Stream 2:
Sustainability & the Circular Economy**

**Social Manufacturing:
Life-long careers, role of education etc.**

Chairperson Dr. Dimitris Mavrikios

- **Future Work and Social Sustainability of Manufacturing in the Age of Digitalisation**
Johan Stahre, Chair Professor and Head of Division Production Systems, Department of Industrial and Materials Science, Chalmers University of Technology
- **Adapting Education and Continuous Training to Industrial Needs**
Dr. Pedro-José Arrazola Arriola, Head of Machining Research Group, Mondragon Unibertsitatea-Faculty of Engineering
- **European Initiatives to Support Skills in Manufacturing**
Doris Schröcker, Head of Strategy Unit for Industrial Technologies, Directorate General Research and Innovation, European Commission
- **Industry 4.0, Jobs for the Future Versus Future With No Jobs**
Luísa Coutinho, Executive Director, EWF- European Federation for Welding, Joining and Cutting / IST- University of Lisbon

**Stream 3:
Collaborative Technological Innovation**

Manufacture 2030 – Panel Discussion

Chairperson Dr. José Carlos Caldeira

- **ManuFUTURE-EU Vision 2030**
Dr. José Carlos Caldeira, President, ANI Porto
- **Manufacturing in Horizon 2020 and Beyond**
Seán O'Reagain, Deputy Head of Advanced Manufacturing Systems and Biotechnologies, DG for Research and Innovation, European Commission
- **Produktion2030: the Swedish Platform for Research and Innovation in Production**
Cecilia Warrol, Programme Director, Produktion 2030, Swedish Association of Engineering Industries (Teknikföretagen)
- **ManuFUTURE-DE 2030**
Prof. Dr.-Ing. Thomas Bauernhansl, Director, Fraunhofer Institute for Manufacturing Engineering and Automation IPA
- **Industrial View on ManuFUTURE Perspectives in FP9**
Dietmar Goericke, Forum Industrie 4.0 Director, VDMA

13:15 - 14:15

Lunch and Partner presentations

- **From Digitalisation to Transformation in Manufacturing Business**
Glen Koskela, CTO and Head of New Business Development, Fujitsu Nordic
- **Telia Eesti Approach to IoT and Manufacturing**
Toomas Kärner, IoT Business Area Manager, Telia Eesti AS

14:15 - 15:45	Manufacturing 4.0: Digital Platforms, incl. Data security Chairperson Chris Decubber	Digitalisation of Manufacturing Chairperson Karen Coleman	New Collaborative Models for Technological Innovation Chairperson Cecilia Warrol
	<ul style="list-style-type: none"> ● Digitising European Industry – Digital Industrial Platforms for the Smart Connected Factory of the Future Max Lemke, Head of Unit, Technologies and Systems for Digitising Industry, European Commission ● Building Secure Data Exchange in Industries According to Estonian X Road Model Oliver Väärtnõu, CEO, Cybernetica ● How the Internet of Things Inspires New Ways We Do Business and Run Companies Dr. Albrecht Ricken, Vice President, SAP Research ● Using the Concept of Industry 4.0 in Modern Factories. Factories 4.0. Adam Gašiorek, Vice President, Transition Technologies PSC 	<ul style="list-style-type: none"> ● Digitalisation and Cooperation in Process Automation Urmo Sisask, CEO, Hylres OÜ Andres Kostiv, User experience (UX) designer, Tieto Estonia ● Personalised Manufacturing from an Automation Point of View Dr. Björn Sautter, Research Cooperations Manager, Festo AG & Co. KG ● Industry 4.0, Industrial Data Space and the Need for Transforming Manufacturing in Emerging Economies Kay Matzner, Head of International Projects, Fraunhofer Institut for Factory Operation and Automation IFF ● Circular Economy and the Digilization of Industry: The FUTURING project George Chryssolouris, Professor, Laboratory for Manufacturing Systems and Automation, University of Patras 	<ul style="list-style-type: none"> ● To What Extent Can Digitalisation Change Collaborative Innovation? Dr. Odd Myklebust, Research Director, SINTEF Raufoss Manufacturing ● Exploring University-Business Partnership and Identifying the Best Fit to Maximise Research Impact Prof. Renno Veinthal, Vice-Rector for Research, Tallinn University of Technology ● How Could Europe Increase the Impact of RDI-investments via P4.0? Dr. Harri Kulmala, CEO, DIMECC Oy ● The Digitalisation of Manufacturing: Challenges and Opportunities for European Advanced Manufacturing Filip Geerts, Director General, CECIMO – European Association of the Machine Tool Industries
15:45 – 16:15	Networking break and Partner presentation		
	<ul style="list-style-type: none"> ● Turning Data into Business Value With Mindsphere lot Ilmari Veijola, Service Manager, Plant Data Services, Siemens Osakeyhtiö 		
16:15 – 17:15	Plenary Session 2: Digitalising the Future Chairperson Karen Coleman		
	<ul style="list-style-type: none"> ● On the Way to Industrie 4.0: Driving the Digital Enterprise Dr. Jan Michael Mrosik, CEO, Siemens Digital Factory ● How ICT Innovations Are Adding to Efficiency in Energy Sector? Hando Sutter, Chairman of the Management Board, Eesti Energia 		
19:30 – 20:00	Gathering starts at the Seaplane Harbour		
20:00 – 23:00	Industry 4.0 Seasons Gala Dinner at the Seaplane Harbour		

WEDNESDAY 25 October 2017

8:30 – 9:00 Morning coffee

9:00 - 10:30

Stream 1: Industry 4.0 in Practice

Industry 4.0: From Theory to Practice

Chairperson Seán O'Reagain

- **Innovation Collaboration Between Start-Ups and Established Players**

Lauri Väin, VP of Engineering, Starship Technologies

- **Factories of the Future – Manufacturing in Horizon 2020 and Beyond**

Dr. Gustaf Winroth, Research Programme Officer, European Commission

- **Estonian Case Study About Product Innovation Through Clustering**

Helena Almqvist, Managing Director, Protex Balti

Stream 2: Collaborative Technological Innovation

Combining New Technologies with New Business Models

Chairperson Günter Hörcher

- **Regional Collaborative Innovation for Meeting Global Manufacturing Challenges**

Enrico Callegati, R&D Funding Manager, CRIT

- **Renewable Energy: How Can You Save and Make Money**

Vidmantas Janulevičius, Chairman of the Board, Global BOD Group

- **Developments in Manufacturing Technologies Research and Co-operation between RTU and CERN**

Toms Torims, Scientific Associate, CERN

Stream 3: Pitch-presentations from 'Factories of the Future' projects

Achieving Factories 4.0: Collaborative Success Stories

Chairperson Patrick Kennedy

- **Use-It-Wisely: Innovative Continuous Upgrades of High Investment Productservices**

Riikka Virkkunen, Research manager, VTT Technical Research Center of Finland Ltd.

- **CAXMan: Computer Aided Technologies for Additive Manufacturin**

Dr. Georg Muntingh, Research Scientist, SINTEF Digital / Quality Assurance Coordinator, CAXMan project

- **FORTAPE: Research on Efficient Integrated Systems for the Manufacturing of Complex Parts Based on Unidirectional Tapes for the Automotive and Aeronautical Industries**

Raquel Ledo, Head of Materials Innovation Area, CTAG – Automotive Technology Centre of Galicia

- **ReconCell: A Reconfigurable Robot WorkCell For Fast Set-up of Automated Assembly Processes in SMEs**

Aleš Ude, Head of Department of Automatics, Biocybernetics and Robotics, Jožef Stefan Institute

- **ConnectedFactories: Industrial Scenarios for Connected Factories**

Chris Decubber, Technical Director, EFFRA

Stream 4: Site Visits

Insight into selected Estonian companies

- **BLRT Grupp**

- **Ericsson Estonia**

- **KARL STORZ Video Endoscopy Estonia**

- **Saku Metall Allhanke Tehas**

- **Saku Õlletehas (Saku Brewery)**

- **Tallinn University of Technology**

- **HUMAN: Human-Centred Manufacturing**
Manuel Oliveira, Senior research scientist, SINTEF
- **CTC Project – Local Flexible Manufacturing of Green Personalized Furniture Close to the Customer in Time, Space and Cost**
Giuseppe Lucisano, Coordinator of Innovation and R&D, SCM Group

10:30 – 11:00 Networking break

11:00 – 12:30 Digital Innovation Hubs for Manufacturing: National & Regional Initiatives
Chairperson Željko Pazin

- **Digital4Industry in the UK**
Dr. Lina Huertas, Head of Technology Strategy for Digital Manufacturing, Manufacturing Technology Centre
- **EIT Innovation Community on Added Value Manufacturing**
Mathea Fammels, Head of Policy and Communications Unit, The European Institute of Innovation & Technology (EIT)
- **I4MS Initiative and Further Perspectives**
Silvia de la Maza, R&D Manager, InnovaValia Association
- **Digitising European Industry – Digital Innovation Hubs Helping SMEs and Mid-Caps in Their Digital Transformation**
Max Lemke, Head of Unit, Technologies and Systems for Digitising Industry, European Commission

Strategies for Industries
Chairperson Rikardo Bueno

- **Metrology: a Key Enabler for National Industry 4.0**
Paula Knee, Head of Analysis and Evaluation, National Physical Laboratory
- **IPC Smart Factory Standards**
David W. Bergman, Vice President Standards & Training, IPC – Association Connecting Electronics Industries
- **Strategic Development of Innovation Policy in Finland**
Dr. Riikka Virkkunen, Research manager, VTT Technical Research Center of Finland Ltd.

Leveraging Innovation
Chairperson Karen Coleman

- **Eurovr Initiative and VR&AR Possibilities in Personalised Product/ Services/ Manufacturing**
Marco Sacco, Head of Division, Institute of Industrial Technologies and Automation, National Research Council of Italy / President, EuroVR
- **INDUSTRY 4.0 Giving New Opportunities for Innovative Cooperation**
Dr. Géza Haidegger, Senior CIM research engineer, MTA SZTAKI / ManuFuture-HU Board-member
- **Poland on the Way to Industry 4.0. Existing Preconditions and Undertaken Measures**
Andrzej Soldaty, Founder, The Initiative for Polish Industry 4.0
- **Collaboration as a Driver for Success in the Digital Era**
Dr. Minna Lanz, Associate Professor of Production Engineering, Tampere University of Technology

- 12:30 – 13:30 Lunch
- 13:30 – 14:45 **Plenary Session 3: Approaches to Technology Collaboration at European, National & International Level**
Chairperson Karen Coleman
- **European and National (Finnish) Experience in Collaboration on R&D in Manufacturing**
Tomas Hedenborg, President, Orgalime
 - **Renault's Interest in Collaborative Projects**
Philippe Montfort, Expert leader, Vehicle Manufacturing Engineering, Renault
 - **Future of Manufacturing – China and USA Perspective**
Dr. Jun Ni, Shien-Ming (Sam) Wu Collegiate Professor of Manufacturing Science and Professor of Mechanical Engineering, University of Michigan
- 14:45 – 15:15 Networking break
- 15:15 – 16:30 **Plenary Session 4: 2020 and Beyond**
Chairperson Karen Coleman
- **Rapporteurs' Reports from the Different Programme Streams**
Prof. Reijo Tuokko, International Cooperation Manager, DIMECC Oy
 - **Ensuring Competitiveness Through Digitalisation**
Urve Palo, Minister of Entrepreneurship and Information Technology of the Republic of Estonia
 - **Research and Innovation in European Manufacturing – present and future**
Dr. Peter Dröll, Director for Industrial Technologies, Directorate-General Research and Innovation, European Commission
 - **Closing of the Presidency Event Manufuture 2017**
Jüri Ratas, Prime Minister of Estonia
- 16:30 **Handing over of the Manufuture flag and closing the conference**

Chairperson of the Conference



Karen Coleman, Broadcaster, Journalist & Author

The award-winning Irish journalist, Karen Coleman is one of Ireland's most accomplished journalists who now specialises in European issues. Karen is the Editor of EuroParlRadio which reports on stories from the European Parliament. A former BBC foreign correspondent, she has been covering international affairs for radio and television for over two decades. She has worked for both the public and commercial broadcast industries including a ten-year stint with the BBC. For many years Karen presented the award-winning international affairs radio show The Wide Angle on Newstalk in Ireland. Karen regularly moderates high-level conferences that cover a wide range of topics from complex EU issues to economic, environmental, health and other topics. She is also a published author.

e-Estonia - a Success Story

Jaak Aaviksoo, Academician, Rector, Tallinn University of Technology

Academician Jaak Aaviksoo was elected Rector of Tallinn University of Technology in September 2015. Former roles have included Minister of Education and Research and Minister of Defence of Estonia. He has also been elected twice as Rector of Tartu University and serves as EUA Board member. Before becoming the Rector of Tartu University he was Professor of optics and spectroscopy at Tartu University heading the Institute of experimental physics. In 1994 he was elected to the Estonian Academy of Science. Rector Aaviksoo has worked in many foreign institutes as a guest professor: Novosibirsk Institute of Thermal Physics, the Max Planck Institute for Solid State Research in Stuttgart, Osaka University and Paris Diderot University. We asked Mr Aaviksoo to explain what experience e-Estonia can share with the world.

What are we proud of in e-Estonia?

Estonia has two strategic success stories in the field of technology. First of all we are a tech savvy nation with a trusting and supportive attitude towards technology. Estonians trust public institutions and their innovations, like the electronic identity card which forms a basis for identity recognition.

Secondly, we have managed to integrate technological innovations horizontally very quickly. That means different partners in society have managed to agree on platforms and moved forward quickly in the implementation of new technologies.

These two aspects have created a culture that we call the “Estonian Start-up Mafia” or “Skype Spillover” consisting of hundreds of people with a technology and entrepreneurial mindset. They believe, that success stories like Skype can be repeated.

One day, we’d also like to be proud of our manufacturing industry, which still lags behind

still being much too workforce instead of ICT oriented.

What experience can e-Estonia share with the World?

Estonian companies can offer innovations based on horizontal integration. We can offer our infrastructure, legislative environment and tech savvy society as a testing ground. For example, we have managed to integrate self driving vehicles by quickly redesigning legislation. Also, we have reacted to new business models of the sharing economy and companies like Uber and Taxify are very welcome. On the manufacturing side, we have built solutions e.g. in logistics that supplement the offerings of multinational players. Starship courier robots co-operate with Mercedes-Benz vans and the Cleveron parcel delivery solution is being tested by Walmart.

What role could Estonia play in an industrial revolution?

I do not consider it realistic to influence mainstream business areas but we can reinforce brave and radical innovation. We have a proven track record of implementing holistic revolutions in the context of the new economy. A good example is the ability to tax the sharing economy and global ICT-players. If we look at Google then we are making great progress in constructive regulation of this economic phenomenon, rather than restricting its actions with bans and orders.



Estonian companies can offer innovation based on horizontal integration.

Moving up the Value Chain – ManuFuture 2030: Strategic Vision

Prof. Dr.-Ing. Heinrich Flegel, Chairman, ManuFuture High Level Group

Prof. Dr.-Ing. Heinrich A. Flegel has a Ph.D. in applied computer science from Karlsruhe University and has also studied mechanical engineering at the University of Aachen. From 1981 to 1996 he worked in Mercedes-Benz AG as a director of machining technology, director of process engineering and director of manufacturing and materials technologies. In Daimler AG he was a director of advanced manufacturing engineering and from 2003-2013 he was a Member of the Supervisory Board. Since 1991 he has lectured in computer science at Stuttgart University. Prof. Dr.-Ing. Heinrich A. Flegel has been Chairman of the ManuFuture High Level Group since 2004, was re-elected 2009, and has been President of DVS (German Welding Society) since 2007. We asked Prof. Flegel about challenges and opportunities for the manufacturing of the future.

What is the importance of manufacturing for the value-added, tax revenues and financing of government tasks in Europe?

It's obviously very important. Through products, industry creates the added value that society lives on. Moreover, high-quality services are also linked to products. If you want to become a rich country, you need a set of high class companies, able to constantly deliver unique products in world-wide demand. This also requires a strong manufacturing base along the entire value chain.

In-depth knowledge of manufacturing engineering is the key to be able to manufacture these products. Manufacturing needs various engineering capabilities, e.g. mechanical engineering, electrical engineering, computer science, material science and technology. Across Europe we have strong engineering faculties and good engineers which would enable us to be world leaders in this field.

Can you talk us through European targets, namely the Juncker Plan and Moedas 3Os?

Both plans offer us opportunities. The Juncker Plan has triggered private investment through state guarantees and created jobs in SMEs. Moedas 3Os mean to look open-mindedly outside the European box for the best in class to learn what and where we can do better from them.

The European Commission's industry target of raising the profile and importance of industry in the economy, from less than 16% today towards an aspirational 20% of EU GDP by 2020 is a big but worthwhile challenge and shows direction.

Europe must capture the qualities of the current industrial base and seize the opportunities in the macrotrends that lie in front of us. We must also make sure that the framework conditions for all businesses are optimal and allow for industry to adapt to new developments. H2020 is a successful program. The LEIT program is important for the manufacturing industry, which is also reflected in industrial participation.

Looking at Industry in the whole EU region, clearly there are big differences between the member states. Getting everyone to the same level will take some time.

What are the challenges and opportunities for the manufacturing of the future?

Manufacturing engineering is highly competitive in Europe. Everyone is looking for high technology coming from Europe. Industry 4.0 is a hot topic. Sometimes we are too slow in implementation. We Europeans need to speed up and join forces. That means more cooperation between different member states. European R&D projects contribute to this. Some countries are very developed in terms of value-added products and pioneers in the development of production technology. Cross-fertilization and integration of smaller countries will accelerate the catching-up process.

What scenarios for Manufacturing will Manufacture Vision 2030 bring along?

Our scenarios are intended to provide visions for future developments and an understanding of economic and social impact of future transformations. We will discuss the scenarios during the conference and integrate the contributions from the participants.

Manufacturing will obviously become much smarter and more networked. Smart Industry 4.0, IoT, big data, data analytics, cloud systems, data security, augmented reality, smart logistics – these could be the points for the future. The car industry is constantly talking about autonomous transportation and Tesla has already promised to offer this possibility next year. It won't happen



Smart Industry 4.0, IoT, big data, data analytics, cloud systems, data security, augmented reality, smart logistics – these could be the points for the future.

quite as fast, but easily within a couple of years. As manufacturing is becoming more difficult, integrated supplier networks are increasingly important here. There's also a lot of potential for additive manufacturing. In 2-5 years, we will have more applications for this. I would also add high performance manufacturing, zero defect manufacturing and conditioning monitoring of production equipment to the list of future topics. These are just some of the points we can already predict now. However, predictions are never easy. We will see more interesting developments. In any case, the future of production remains exciting and challenging.

Realising Europe's Industrial Potential



Maurizio Gattiglio, Chairman, EFFRA

The future of manufacturing in Europe is a future built on research and innovation. It is a future that is being enabled by the European Union's €1.25 billion advanced manufacturing research and innovation partnership, Factories of the Future.

At ManuFuture 2017, Maurizio Gattiglio will provide insight into the future of advanced manufacturing Europe, covering topics such as advanced mechatronics, digitalisation, artificial intelligence and sustainability.

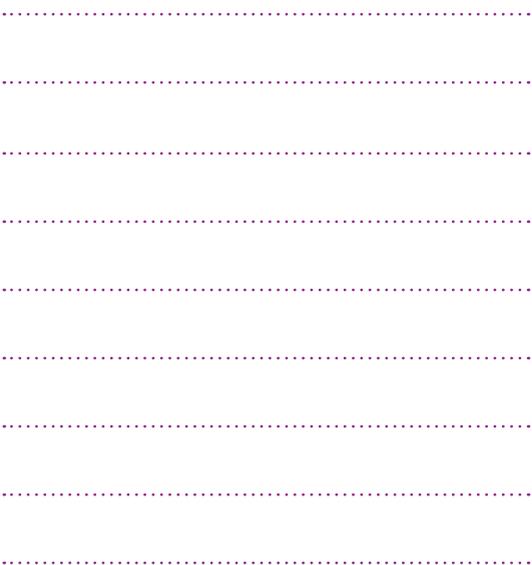
Mr. Gattiglio will present this public-private partnership (PPP) on behalf of the European Factories of the Future Research Association (EFFRA), the association which represents the industrial and research community within the PPP.

During his presentation, Mr. Gattiglio will show how projects are providing solutions to challenges faced by industry and how this enables the realisation of industry 4.0 due to the multi-sector nature of the partnership. Over 250 projects have been launched since the start of the PPP with many having exploited their results as solutions within the factories and have launched spin-offs.

The 2018 Factories of the Future call for project proposals is open and these opportunities for research and innovation funding will be presented as will the 2019 topics for the next call. Participants will be encouraged to make use of EFFRA's online innovation portal to identify potential project partners.

A successful re-industrialisation of Europe will not be achieved at European level alone and therefore the harnessing of the potential of national and regional initiatives will be elaborated upon by Mr. Gattiglio. The efforts of EFFRA and its members in this context will be described.

Mr. Gattiglio will also present the outcome of the recent positive mid-term assessment of the Factories of the Future PPP and what this may mean for the future of EU support for advanced manufacturing research and innovation.



EU Industrial Policy Strategy: Investing in a Smart, Innovative and Sustainable Industry

Lowri Evans, Director-General of the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
European Commission

Lowri Evans was appointed Director-General of DG Internal Market, Industry, Entrepreneurship and SMEs on 1 September 2015. She has been Director-General in DG Maritime Affairs and Fisheries from 2010 to 2015. Prior to that, she has worked in several policy areas in the European Commission notably Competition and Employment. She started her professional career in audit and accountancy with Deloitte.

- A Renewed EU Industrial Policy Strategy to make European industry sector more competitive
- Steps towards a smart, innovative and sustainable industry
- European Commission's efforts in putting strategy into practice together with Members States



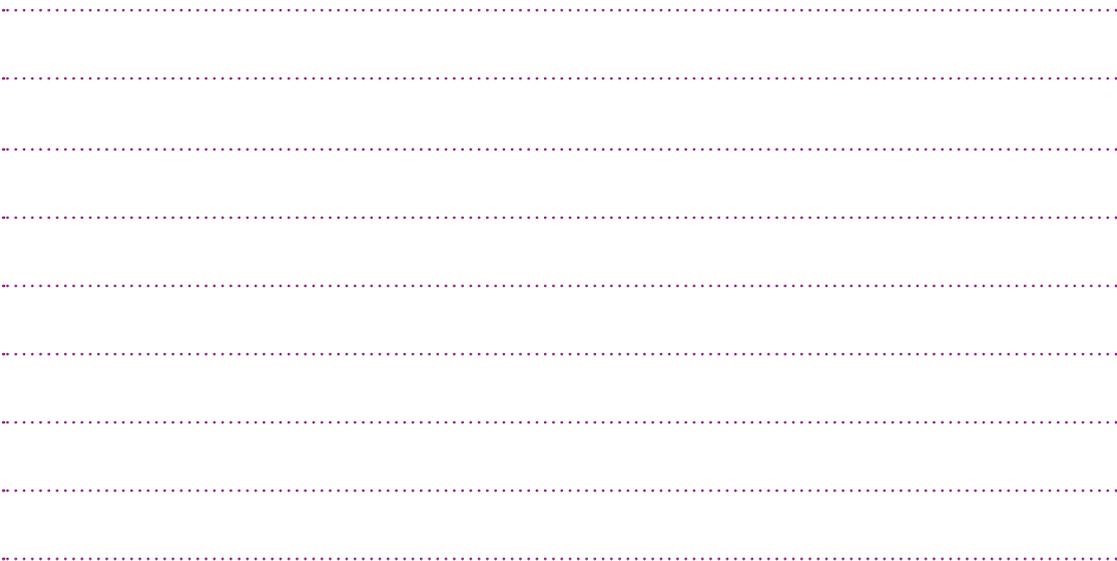
Capturing Silent Knowledge of Machine Whisperers



Ergin Tuganay, Partner & Head of Industry 4.0, Nortal Oy

Ergin has over 10 years of personal experience on wide range of responsibilities in Manufacturing Operations Management and industrial ICT domain including solution scans, blueprints, roadmap design, sales support, training and implementation tasks based on industry standards.

- Aging of the workforce is impacting a number of industries
- Retirement of experienced workers is expected to create a skills gap
- How data and intelligent automation of processes will help fulfilling this gap
- Using data to secure profitability for manufacturers and creating new business models for machine builders



Becoming a Digital Industrial Company – the Brilliant Factory Initiative

Claudio Kantner, Brilliant Factory Leader, GE Power

Claudio Kantner leads the Brilliant Factory program @ GE Power Conversion in Germany. Using Lean and Digital to develop a Berlin Site into a Brilliant Factory. We asked Mr Kantner to explain GE's Digital Thread and how to become a Brilliant Factory.

What is GE's Digital Thread and how does it contribute to digitalisation?

The Digital Thread is how GE connects machines, analytics and people, to help organizations make informed decisions that improve the way they sell, manufacture, design, service and operate.

The Digital Thread is how we gain deeper insights into data generated by machines by connecting people and assets.

By connecting people, machines and analytics, organizations can make smarter decisions and improve business efficiencies.

We are focused on five Digital Thread product lines: Services, Supply Chain, Global Operations, Commercial and Engineering. Any vertical business can benefit from better management, execution and forecasting for people, processes and things. The focus on these five product lines

lets IT prioritize and create a single set of products to suit all businesses.

We delivered \$730 million in digital thread productivity in 2016 and are on track to reach \$700 million in 2017.

What is Brilliant Factory and how to become a Brilliant Factory?

Brilliant Factory is an initiative within GEs overall digital thread. Brilliant Factories Link design, engineering, manufacturing, supply chain, distribution and services into one globally scalable intelligent system.

So far, there are 25 plants that are certified as Brilliant Factories. Brilliant Factory can be broken down into four pillars...Lean, Advanced MFG, Additive, Digital. These plants benefit from greater productivity and efficiency.



By connecting people, machines and analytics, organizations can make smarter decisions and improve business efficiencies.



Turning Ideas into Reality: The Journey of One Leading Manufacturer into the Industrial IoT

Hans Michael Krause, Director Market and Product Management PLC and IoT, Bosch Rexroth AG

Hans Michael Krause is the Director Market and Product Management PLC and IoT Systems at Bosch Rexroth AG in Lohr am Main, Germany. He has a diploma degree in Electrical Engineering and a masters in Industrial Management and started his professional career in Argentina working as an independent automation engineer. Since 2007 he has been working with Bosch Rexroth's packaging machine building and FMCG customers. Since July 2017 he has been responsible for Bosch Rexroth's PLC Automation and IoT Solution business. We asked Mr Krause to explain the developments at Bosch in terms of Industry 4.0.

What are the developments at Bosch in terms of IoT and Industry 4.0?

IoT and Industry 4.0 are affecting all four of our main business units. Connected cars and autonomous driving are hot topics in the automotive industry. In household appliances, we are already talking about connected refrigerators notifying you when something is missing from your fridge. The same goes for our building business and of course the industrial business, where Bosch Rexroth is a major supplier for automation equipment and components. Hence, all four pillars of Bosch are strongly affected moving us towards transforming into an IoT company. It all started from a project bringing together IoT enthusiasts from all business units. Now the same initiative has grown into a project house Bosch Connected Industry. Bosch is a clear frontrunner in this area. Looking at rankings in market influence, Bosch is always amongst the top 10 IoT companies next to other giants like GE and Siemens.

Bosch is both the leading user and leading supplier for Industry 4.0. What are some projects that you are particularly proud of?

People tend to think that implementing IoT projects takes a lot of resources both in terms of thinking and time. Our IoT projects started from small pilots where we tested the benefits these technologies could offer. This quickly evolved into more than 150 pilot projects in our plants. After pilot projects we used the learnings of the benefits to change complete value streams based on our experiences. As an example, in 2015 we introduced a multiproduct line in our plant in Homburg, Germany. Instead of having seven different lines, a variety of products can be produced within a single line. The change over time is zero seconds for these different products.

As a next step we also have international production networks, e.g. for ABS production, where more than 5000 machines in 11 plants across the world are connected. Machines can be monitored against each other in order to improve

performance.

Bosch started from small pilots and has quickly moved to complete international production networks. Our future lies within these quick developments. Thus far, the multiproduct line and connected production network have been some of our highlights on this journey.

Bosch is also the leading supplier of connected automation solutions. Can you name a few exciting solutions currently on offer?

When buying Bosch products, you can be sure that everything has already been tested in our own plants and that we have the experience to develop products for real plant needs. It's a strong benefit.

We are very proud of our connected tightening system Nexo which is used in the car industry. The torque data of the tightening process is saved in a process quality database, which allows us to find process improvements through data analytics. Obviously, it's impossible to have a complete set of the newest machines. Our IoT Gateway brings older machines into IoT. Thanks to our interactive line information system ActiveCockpit, line performance data is presented digitally, which saves a lot of preparation time for the line manager. Bosch offers a wide spectrum of opportunities and is oriented to further development to meet the real needs of the industry.

What are your next steps and future activities in this area?

As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected industry. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. Bosch is not only a leading user of Industry 4.0 but also a leading provider.



Bosch started from small pilots and has quickly moved to complete international production networks.

We are currently focusing our activities on our Bosch Connected Industry. Equipped with a view of the bigger picture as well as the expertise that comes from our own manufacturing activities in more than 270 plants, our experts are in a position to support clients in implementing connectivity solutions in their own production.

At Bosch, we combine expertise gained from our own manufacturing activities with our competence as a leading provider of industrial solutions along the value stream.

As a leading user, we are not only optimizing our own worldwide manufacturing base in numerous plants. We also are actively seeking to work with our partners to build a value-creation network beyond company boundaries and turn Industry 4.0 into reality.

Has Europe Lost the B2C Revolution & Will Europe Win the B2B Digital Industrial Revolution?

Cecilia Bonefeld-Dahl, Director General, DIGITALEUROPE

Cecilia Bonefeld-Dahl has more than 20 years of experience in the ICT industry. She previously held international positions with IBM and Oracle as well as with SMEs building businesses across Europe and China, and founded the cloud provider GlobelT. She has deep insight into the digitalisation of Business and Society. We asked her to explain what could enable Europe to become a pioneer in digitalisation and where are we in terms of digitalisation.

What can enable Europe to become a pioneer in digitalisation? What is the biggest obstacle on this path?

The enablers are digital skills, a safe cyber environment and a strong digital infrastructure in Europe. Without these three in place, companies will not be competitive in the digital era.

The biggest obstacle is the political and regulatory fragmentation of Europe – in short it is a problem that Europe is still not one but 28 different countries. European SMEs do not have one single uniform market where they can scale and grow. The consequence is that many fast-growing companies leave Europe, e.g. in the Nordics studies show that 2/3 of the digital Unicorns leave the Nordics within the first two growth phases because they cannot find the right competences, capital and it is too costly to penetrate and grow in the European countries one by one fighting fragmented regulations each time.

So basically, European leaders are shooting themselves in the foot, when they insist in having different rules in each country.

We need the Prime Ministers to get together and understand that Europe is a part of their

responsibility and they must align digital policies amongst themselves to create one connected strong digital single market for the benefit of all Europeans, and this is also what we see happening now with the Tallinn Summit where all Heads of State met on the 29th of September and again on the 19th of October where the Digitalisation of Europe was on the agenda at the Council meeting in Brussels. This is a major step forward.

Looking at the enablers, the EU has started many good initiatives and investment within digital skills amongst others for upskilling of resources in traditional industries. DIGITALEUROPE carry the mandate of the digital skills and job coalition in Europe, and we are now in close collaboration with the new Commissioner for Digital Gabriel, in finding a few streamlines programs and initiatives that can make a difference using the existing structures and the coalition.

Where are we now in terms of digitalisation?

You could say that as of today the US has been first movers in B2C digitalisation - Facebook, Google, Amazon they all saw it coming, business models based on data and global scale making peoples everyday lives easier, so Europe is

Industry 4.0 - Where to Go



Joost van Iersel, President of the ECO Section, European Economic and Social Committee

Joost P. van Iersel (1940) started his professional career in 1967 as a civil servant in the Ministry of Economic Affairs. Subsequently, he was secretary of a Dutch Employers Association. From 1979 till 1994 van Iersel was MP (christian-democrat), in particular responsible for trade and industry and EC-matters, amongst others also as President of the European Movement. From 1992 till 2002 he was chairman of the Chamber of Commerce of The Hague with a special interest for regional infrastructural and spatial development in the Randstad. Van Iersel acted as commissioner in several companies and was on the board of various social organisations. From 2002 he is Member of the European Economic and Social Committee. From 2006 till 2010 he chaired the EESC Consultative Committee on Industrial Change. Subsequently, he presided the EESC Steering committee Europe2020. Since April 2013 Van Iersel chairs the EESC Section EMU and Regional and Cohesion policy. His main fields of interest as a rapporteur in the EESC are industrial policy - notably value-chains and digitalisation in industry (4.0) -, good governance of the Eurozone, and European metropolitan areas. Van Iersel gives lectures and writes articles on political economy and Europe.

- Digitalisation in health and care
- Free flow of data
- Geo-blocking

Future Work and Social Sustainability of Manufacturing in the Age of Digitalisation

Johan Stahre, Chair Professor and Head of Division Production Systems, Department of Industrial and Materials Science, Chalmers University of Technology.

Professor Johan Stahre heads the division of Production Systems at Chalmers University of Technology in Göteborg, Sweden. He is codirector of the national Swedish programme of manufacturing research and innovation, Produktion2030 and is deeply involved in European manufacturing research policy efforts like EFFRA and Factories of the Future. Stahre's scientific publications and background are focused on manufacturing systems research, specifically the interaction and collaboration between automation and people. We asked Prof. Stahre about the impact of digitalisation and automation on future manufacturing and some of the ways to achieve social sustainability in future manufacturing .

What will be the impact of digitalisation and automation on future manufacturing?

You may find numerous books about the impact of automation and digitalisation claiming that everything will be automated using AI and that most of the jobs will disappear. But there is actually no consensus yet. Similar discussions have been popping up throughout our history, even as early as in the 1800s. In the 1960s the US President set up an initiative to analyse the impact of automation on American workers. They concluded that increasing automation led to more jobs and prosperity. If the great numbers of robots have taken over then why is the unemployment so low and why isn't productivity rising rapidly along with the increased automation?

Automation has been present in manufacturing for a very long time. The first digitalised machines were used already in 1950s. The tasks and skill sets required will change but I don't believe automation will take over all manual work. A study by McKinsey this year claims that 5%

of occupations will disappear by 2030. The most important conclusion is that in 60% of occupations, 30% of the tasks will be automated. Hence, it's more about adapting and occupational changes as opposed to jobs actually disappearing. In fact, due to the problematic demographics of Europe, we will need to automate a lot to sustain our global competitiveness.

What are the paradoxes of automation?

In 1982 the psychologist Lisanne Bainbridge pointed out the paradoxes of automation and how we will still depend on the human who programmed or designed the automated system. Artificial intelligence may be able to learn new skills. Therefore, you have two possibilities: you can either integrate the need skills in the technology from the start and later adjust its behavior. Or you can let the system learn all tasks by experience. The latter takes a lot of time.

The second paradox is that there will always be some tasks that cannot be automated (oversight,

Adapting Education and Continuous Training to Industrial Needs

Dr. Pedro-José Arrazola Arriola, Head of Machining Research Group, Mondragon Unibertsitatea-Faculty of Engineering

Dr. Pedro-José Arrazola Arriola is a Senior Lecturer of Mechanical Engineering and the Head of the Machining Laboratory at Mondragon University. He is also an Associate Member of CIRP (The International Academy for Production Engineering). He has been active in metal machining for the last 2 decades, publishing over 125 research papers in peer-reviewed journals and conferences. He has 2 patents (Temperature Measurement in Drilling, On-line Measuring of Component Distortions) and one I.P.R. (Finite Element Model of Chip Formation Process). His current research interests are: cutting fundamentals (modeling and experimental), machinability, process monitoring and machining optimization. In recent years he has focused his research on the machining of aeronautical applications. We asked Dr. Arrazola Arriola about what might be keeping young people from entering this sector and how to fit people into this ever-changing landscape of manufacturing.

There is obviously a lack of work force in the manufacturing sector. What might be keeping young people from entering this sector?

The main issue is awareness. You rarely get a glimpse inside the world of manufacturing. Young people have little to no understanding of how this area actually works. Today, most jobs are offered in the manufacturing and engineering sector, but young people at the age of 18 have a hard time choosing this path because they have no idea what they are getting into. We do have some programs on Spanish TV showing how cars and food are produced, but that's clearly not enough.

I believe we need to start from primary school. Similarly to the robotics courses we have at universities, we could organise simplified attractive workshops for smaller kids using LEGO for example. Hence, transparency and exposure from an early age is key here.

Even if we're able to tackle this issue of popularity, we are still forced to bring in work

force from areas outside of Europe. Do you agree?

Correct! There is a strong probability that this will indeed happen. In the case of Spain, we are already lacking professional teachers in the area of manufacturing. As a manufacturing country, we also need trained factory workers and regional governments are becoming very concerned that young people are not very interested in these jobs. The situation is not yet critical, but clearly getting worse, encouraging us to look for people from all over the world. Bringing in people means that we still need to provide training, which involves additional cultural and other challenges.

Nowadays, manufacturing and production are becoming increasingly flexible. Orders and the type of products are changing on a daily basis. In terms of work force, how can we adapt people to this ever-changing landscape?

The time it takes for a person to attain a master's degree in manufacturing is very short

compared to a company's lifecycle. Modern companies demand continuous training, that's life long learning. This is something universities need to acknowledge. Instead of teaching detailed subjects, we should focus on the students' ability to adapt to change and this mindset needs to be developed from the very early stages (primary schools).

Secondly, our degrees need to be much more flexible and meet the real life needs of companies. The degrees on offer are still very much organized along conventional lines, and it is almost impossible to find a course combines different skills already needed today - not to mention the needs of the future. We are all convinced about the further digitalisation of manufacturing, so why don't we have a degree combining manufacturing and telecommunications for instance?

And finally, there are a lot of people working in manufacturing companies who aren't aware of current and future demands. We need to organise training courses and bring these people to universities.



“ Instead of teaching detailed subjects, we should focus on the students' ability to adapt to change and this mindset needs to be developed from an early age. ”

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European Initiatives to Support Skills in Manufacturing

Doris Schröcker, Head of Strategy Unit for Industrial Technologies, Directorate General Research and Innovation, European Commission

Doris Schröcker leads the Strategy Unit for Industrial Technologies in the European Commission, Directorate General Research and Innovation. We asked Ms Schröcker about future skills needs and how to train future workers in these industries.

What are the future skill needs and how should future workers be trained for industry?

The European Commission is collecting information regarding the skill needs of future workers in industry. If you ask about the main trends, I would say they are related to advanced technologies, digital skills and interdisciplinary skills, especially in the area of merging digital knowledge with other skills.

Can you talk us through the 'Digital Skills and Jobs Coalition' and the 'Blueprint for Sectoral Cooperation on Skills'? How do they support co-operation among education, employment and industry stakeholders?

The 'Digital Skills and Jobs Coalition' is a group consisting of EU Member States, companies, social partners, non-profit organisations and education providers. The European Commission doesn't have EU policy competence in education and training. But EU policy can support Member States in their actions. Currently the coalition provides a forum for discussions for those who want to take action to tackle the lack of digital skills in Europe. For example, the coalition discusses the skills needed in the area of software, software integration, embedded systems, artificial intelligence (AI) and much more.

If we talk about the 'Blueprint for Sectoral Cooperation on Skills', then in a way it's an equivalent to the first group except that skills are addressed in a sectorial context. Here, manufacturing industry's needs are analysed in more detail. Industry combines knowledge from different areas like chemistry, biotechnology, robotics, business, etc. Hence, the aim for this initiative is to identify what skills are needed by industry and then designing corresponding sectoral skills strategies and developing vocational education and training curricula based on updated or new occupational profiles. The discussions in the different sectors vary around a wide range of questions. How much digital and what specifically will be needed? How to encourage companies in using machine learning and modelling? What kind of education will be needed for that?

Many speakers are referring to the Knowledge and Innovation Community (KIC). What is KIC and how is it re-shaping the education landscape?

The Knowledge and Innovation Community on Added Value Manufacturing initiative doesn't exist yet. In 2018, as part of KIC, the European Institute of Technology is planning to launch a call where different parties within the industry

are able to team up and set up a structure, which would reflect the needs of the industry. We are talking about cooperation between educational institutes, academia and business. The purpose is a visible impact of the KIC on added value manufacturing, on the educational landscape. The opportunity is out there and whoever is interested is invited to team up and submit a proposal.



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Main trends are related to advanced technologies, digital skills and interdisciplinary skills.

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Industry 4.0, Jobs for the Future Versus a Future with no Jobs

Luísa Coutinho, Executive Director, EWF- European Federation for Welding, Joining and Cutting / IST-University of Lisbon

Luísa Coutinho has coordinated and participated in more than 100 national and international research, transfer of technology and training projects since 1986 and has published more than 200 books, papers in national and international journals. Her work has been recognized internationally in different forums through two honorary doctorships and ten international awards. We asked Ms Coutinho about the role of international qualifications and adjusting professional skills to industry needs.

You have emphasized the role of international qualifications and adjusting professional skills to industry needs. What is the role of these qualifications and skills?

In any sector and especially in manufacturing, international qualifications are a very efficient way of innovating the required training and qualifications. Additive manufacturing is a clear example here. By creating an international qualification in additive manufacturing with the input from the network of countries we have in EWF, we are able to pinpoint the actual skills needed in this area and in turn adjust national qualification practices in different European countries. Start from a well-known and developed qualification. The role of international qualifications is to encourage the acquisition of new skills in manufacturing in order to keep pace with innovation.

How is training and qualification in the welding sector evolving to match the skills needs?

The welding profession has changed significantly in the past years and will change even more in the near future. Manual welding will

always be there for repairing and maintenance. At the same time, welding processes and materials have developed very quickly. The tendency is clearly moving towards further mechanisation and automation. A welder is no longer the person who only does manual welding. Now he's required to have the knowhow for operating robots and complete units of production that might incorporate other manufacturing processes besides welding. And of course, we can't forget about digital skills, which are already slightly incorporated into the courses linked to automated and robotised welding. This is certainly an area where we need to consolidate more in the training we do.

To this day, welding has been considered a simple job, which doesn't require much education. Now workers are expected to operate complex machinery. Isn't it contradictory? Is it possible to re-educate current welders or should we start fresh with a new generation of welders?

To put it bluntly, it's not the same welder who welds garden gates and the one who welds bridges or cars. The welding processes can be the same and both can be done manually, but the

skills required are completely different. The latter needs to have an understanding of materials and their behaviour. Otherwise, the bridge or the car will fall apart. Hence, it's also a different level of responsibility. The human eye and brain will always outperform a machine. As mentioned, the welder will need to handle difficult jobs in the future. The same manual welder will operate robots and complete digital manufacturing solutions, which requires additional skills. Therefore, workers of all levels will be needed.

Manufacturing is very mobile. Big projects are conducted across all EU countries, which requires a certain degree of flexibility from the workforce. At the same time, EU laws are rather strict. How can we combine these two in the future?

The welding sector is an example of the mobility of workers since welded constructions are built everywhere in the world and sometimes in remote locations, like for example oil platforms. Most professions in welding, from welding coordinators to welders have tasks and responsibilities defined in standards. EWF awards welding professionals with international qualifications. Provided that the person has our international certificate, he/she is going to be accepted as a skilled professional anywhere in the world. Welding is a very mobile



The role of international qualifications is to encourage the acquisition of new skills in manufacturing in order to keep pace with innovation.

sector and therefore can serve as an example of achieving this desired level of flexibility. International qualifications, recognised by stakeholders, are a clear contribution to this goal.

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ManuFUTURE-EU Vision 2030



José Carlos Caldeira, President, ANI Porto

José Carlos Caldeira is the President of ANI – Agência Nacional de Inovação, the Portuguese National Innovation Agency. He is also a member of the High Level Group of the MANUFUTURE Technology Platform and Chairman of its National and Regional Technology Platforms Group. He is National Delegate of HORIZON 2020's NMP+B Programme Committee and, since 2012, DG Regio RIS3 expert.

From 2001 to 2014, he was a member of the Board of Directors at INESC TEC – Associated Laboratory coordinated by INESC Porto. Until 2014, he was the Executive Director of PRODUTECH – Pólo das Tecnologias de Produção – a cluster of more than 90 organizations targeting the development of production technologies for the manufacturing industry.

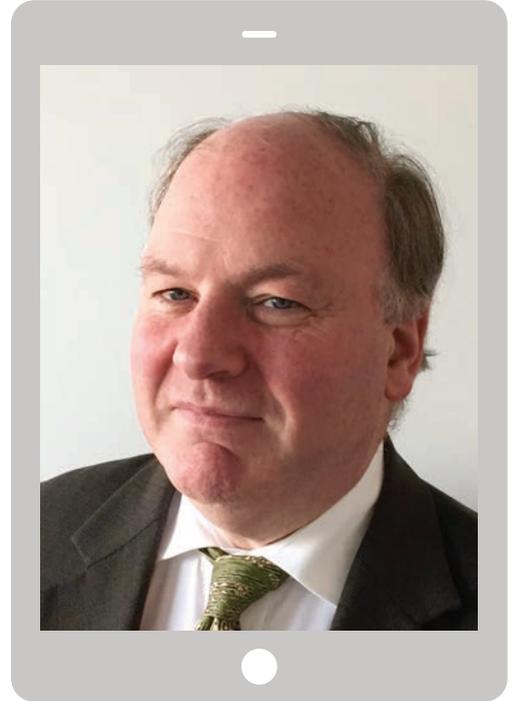
- Process towards MANUFUTURE VISION 2030
- Main results of the work done so far

Manufacturing in Horizon 2020 and Beyond

Seán O'Reagain, Deputy Head of Advanced Manufacturing Systems and Biotechnologies, DG for Research and Innovation, European Commission

Sean O'Reagain is Deputy Head of Unit, "Advanced Manufacturing Systems and Biotechnologies" at the European Commission's Directorate General for Research and Innovation. In this capacity he implements policy and actions under the Horizon 2020 Framework Programme to promote sustainable industrial innovation by incorporating knowledge in high-value-added products and highly-efficient processes. In this regard, Mr. O'Reagain oversees the contractual Public-Private Partnerships on Factories of the Future, Energy-Efficient Buildings and the Sustainable Process Industry.

Mr. O'Reagain was previously responsible for the Joint Technology Initiatives with industry and the European Technology Platforms. Prior to that, he managed the benchmarking for competitiveness and innovation programme in the Commission's DG GROW.



Produktion2030 – A Swedish Platform to Strengthen Innovation in Production



Cecilia Warrol, Programme Director, Produktion 2030, Swedish Association of Engineering Industries (Teknikföretagen)

Produktion2030 is the Strategic Innovation Platform aimed at the Swedish manufacturing industry, academy and research institutes. Produktion2030 combines cross sectorial collaboration with testbeds, education, dissemination and more, in order to have a long term impact on the competitiveness of Swedish manufacturing industry.

Produktion2030 is built on a number of tools, necessary to meet the industry's challenges:

- Testbeds
- Innovation projects
- Education
- Dissemination to SME:s
- Internationalization and analysis

In addition, Produktion2030 will launch a number of strategic projects to accelerate digitalisation in the manufacturing sector. Standards, digital infrastructure and education accessible for industry and students are some examples.

Produktion2030 is part of "Smart Industry", the Swedish governments long term strategy for industrial renewal, growth and sustainable competitiveness. Produktion2030 has a long term funding, beyond 2020, which will secure the impact of its collected efforts and collaborations.



Prof. Dr.-Ing. Thomas Bauernhansl, Director, Fraunhofer Institute for Manufacturing Engineering and Automation IPA

The national technology platform »MANUFUTURE © -DE« represents the interests and visions of German manufacturing industry. Sponsored by the Federal Ministry of Education and Research (BMBF), the national platform is being repositioned, under the leadership of the Fraunhofer Institute for Manufacturing Engineering and Automation IPA, since the beginning of 2016. The aim of this project is to identify the future needs of the manufacturing industry to support the design of research programs as well as support the industry in its strategic orientation. To achieve this, workshops, online surveys and expert interviews were held for this purpose, in close cooperation with industry associations and representatives from industry and research. As a result, the priority research fields and research topics as well as recommendations for action for the design of the innovation system were identified. This presentation presents the argumentative derivation of the investigation and gives an overview of the identified priority research topics with regard to manufacturing in 2030.

- ManuFUTURE-DE drove a structured process to combine societal megatrends with scientific visions and future industrial needs
- With a broad involvement of stakeholders in Germany technological trends and research themes have been identified
- The result is a Strategic Research Agenda for manufacturing technologies with a time horizon around 2030

From Digitalisation to Transformation in Manufacturing Business



Glen Koskela, CTO and Head of New Business Development, Fujitsu Nordic

Glen is CTO and Head of New Business Development at Fujitsu Nordic. He drives co-creation activities with customers and helps them to digitalize their business and operations with Fujitsu's R&D capabilities. Glen was granted the title of Fujitsu Fellow in 2015. Being passionate about industrial innovation methods and processes, he participates actively in the work of national innovation system and serves as Chairman of Innovation Working Group for the Federation of Finnish Technology Industries.

- Building a digital capability by merging existing business, production and operational environments
- Factory-wide data and analytics offer new insights that encourage process improvements in real-time
- Transformation of manufacturing as a business: factory management, business operations and customer service
- Smart manufacturing as a source of industrial competitive advantage
- An example how companies have created a completely new operating environment, operating model, performance indicators, and management model

Telia Eesti Approach to IoT and Manufacturing

Toomas Kärner, IoT Business Area Manager, Telia Eesti AS

Toomas Kärner is leading the IoT Business area for Telia Estonia, one of the largest telecommunication companies in the Baltic states and the member of Telia Company. He has deep dived into exploring the trends and corporate side of the business and also collaborates with startups and new businesses in search of the most suitable solutions. Toomas Kärner holds a bachelor's degree in IT Management from the Estonian Business School.

Presentation will cover:

- Telia's current relation to B2B sector
- Strategic Approach towards IoT
- Project Example in Digitized Product
- Approach towards Digitized Manufacturing



Digitising European Industry – Digital industrial Platforms for the Smart Connected Factory of the Future



Max Lemke, Head of Unit, Technologies and Systems for Digitising Industry, European Commission

The Digitalising European Industry initiative aims to reinforce the EU’s competitiveness in digital technologies and to ensure that every industry in Europe, in whichever sector, wherever situated, and no matter of what size can fully benefit from digital innovation.

To achieve this, a number of operations are being executed on a European level, for instance on Digital Innovation Hubs and Digital Industrial Platforms. Digital Innovation Hubs facilitate the take-up of digital technologies by SMEs. Digital Industrial Platforms integrate various functions implemented by different technologies via clearly specified interfaces, and make data available for use by applications. Standardisation of platform components and interfaces enables inter-operation within and among factories.

With a focus on smart manufacturing Max Lemke will explain in more detail the concept of digital industrial platforms and the 300M€ programme under Horizon 2020, which is planned to support platform building.

Building Secure Data Exchange in Industries According to Estonian X road Model

Oliver Väärtnõu, CEO, Cybernetica AS

Oliver Väärtnõu joined Cybernetica as the Chairman of the Management Board in 2014, having previously served as the Strategy Director of the Government Office of the Republic of Estonia and as the CEO of ELIKO Technology Competence Centre. He has also worked in Sweden and Denmark, focusing on international relations and management consulting. Currently, Mr Väärtnõu is the Member of the Research and Development Council to the Prime Minister of Estonia, Member of the Board at the Estonian Chamber of Commerce and Industry and Member of the Supervisory Board at Smartmatic-Cybernetica Centre of Excellence for Internet Voting. He has a MSc in Technology Governance from the University of Sussex.



How the Internet of Things Inspires New Ways to Do Business and Run Companies

Dr. Albrecht Ricken, Vice President, SAP Research

Dr. Albrecht Ricken is vice-president for future business network applications at the SAP Innovation Center Network. He claims that Industry 4.0 is only the beginning. We asked him what he meant by that and what the new business platforms will look like.

You claim that Industry 4.0 is only the beginning. What do you mean by that?

Industry 4.0 is the application of Internet of Things (IoT) to manufacturing and logistics. However, if you look more broadly, our work world is going through major shifts. Values are changing and will be reflected in the way we work in the future. We are moving towards collaborative working. Many borders are blurring - one of them being the understanding of what is inside a company and what is outside.

More and more processes become highly collaborative. It will resemble the way we navigate around social networks. Thanks to IoT we will always have a digital twin shared in the cloud. This means we can share beyond company borders and we arrive at something called ad-hoc collaboration.

Industry 4.0 will blur the borders between a product and a service. This has been discussed for the past 10 years and is now really picking up speed.

It also changes the way we work with IT. IT facilitates sharing and, thus, IT will become less central and less hierarchical. We are moving into more democratic organisations and into an ecosystem driven by shared values. In the past corporate, IT has been a very lengthy business.

We analysed requirements, did a blueprint, implemented a system, had cut-offs, went live with productive operations - it took easily a year to do all of this. If we look at the way kids use IT today: they download a small app, try it out and if they don't like it, they just throw it away. We need ad-hoc IT where companies will exist in the same business network and share processes. This is what I see as the next step in IT evolution.

You mentioned the ad-hoc mentality in IT. Do you consider this as the main shift in values or is there more?

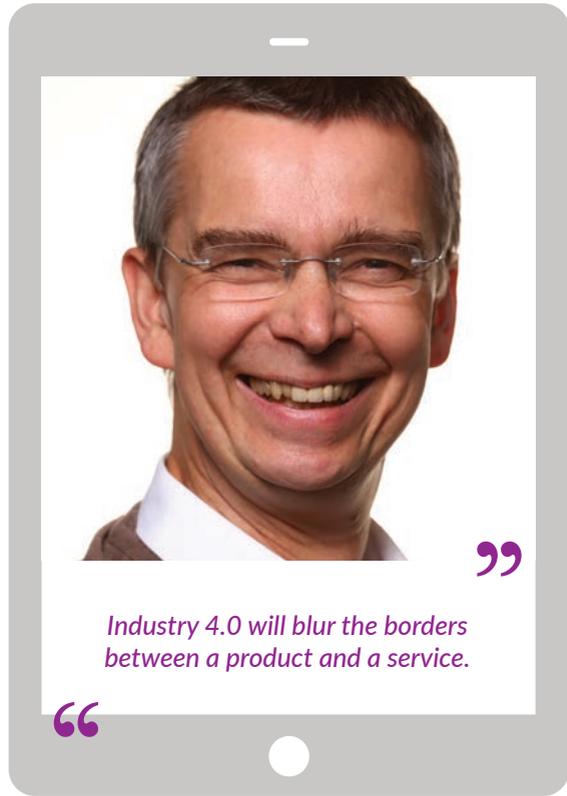
There are a lot of shifts taking place, all driven by the values our future workforce will have. We are moving towards a gig economy, where people are not necessarily employed when they work with a company. They work as freelancers and loyalty to a specific company can change very quickly. They operate throughout the network rather than through an employment contract. People will define themselves by communities, not institutions. Communities can drive the political agenda and create products. Think of the Linux community that brought us an operating system which has been in commercial use for many, many years. It is an example that communities are capable of creating dramatic value.

Companies are shifting towards a more democratic organisational approach. We can already see companies testing holacratic concepts. Traditional IT has been made for the hierarchical organisation, not the network. This is where IT needs to change. All these values are driven by the internet.

What do you mean by ‘things will move centre stage’?

We are used to document-driven IT. Now, individual things will move to the centre. The same applies for manufacturing and logistics. In 2013, Amazon published a video on YouTube about their innovative quadcopter delivery – their concept for the future. Essentially after making a purchase on Amazon, your product will be delivered by the quadcopter straight into your backyard. If you look past the amazing technology, you will notice that the product has moved to the centre. We associate processes with the product and they are no longer controlled by an abstract material. This trend will move to mass manufacturing and logistics.

Another example comes from the Hannover fair a couple of years back. Festo was demonstrating manufacturing equipment where an individual piece was able to find its way through a complex manufacturing environment. The work piece was simply looking for its way around production rather than having a central system that would do some optimisation and then assign it to a resource. This high degree of agility is what will really generate value in the future.



What will the new business platforms look like?

There has been a lot of talk about having the platforms in the cloud. This might make things for the IT department slightly cheaper and easier, but it will not add value to the whole ecosystem. This can be achieved by sharing things in the cloud, anything from contracts to products. Instead of having several documents for the vendor and the buyer, we will have one single file shared between the parties.

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Using the Concept of Industry 4.0 in Modern Factories. Factories 4.0.

Adam Gąsiorek, Vice President, Transition Technologies PSC

Mr. Gąsiorek is a strong advocate of agile methodologies and culture of innovation. We asked Mr. Gąsiorek to describe the major trends in Industry 4.0 and Factory 4.0 and to share his experiences in different projects.

What are the major trends in Industry 4.0 and Factory 4.0?

All major trends are focused on putting a human back into the loop. By taking advantage of digital-physical convergence we are able to place workers at the centre of manufacturing systems to improve safety, operational awareness and democratize decision making. The Internet of Things and Augmented Reality together allow a controlled collision of physical products and their digital twins which enables huge opportunities to improve human engagement and productivity, facilitate knowledge sharing and employee adaptation. IoT- and AR-based solutions make a development of competencies and knowledge transfer faster and easier through more effective lifelong and high-quality training content, job shadowing and training on-the-fly. Last but not list is Machine Learning - making self-learning mechanisms, ongoing process optimization, predictive maintenance or state/demand forecasting possible.

Please tell us about examples of ready solutions - digital automation, data science and BI, optimization, Augmented Reality...

We offer several solutions around Augmented and Mixed Reality:

- Technical Product Information delivery for After-Sales Support in food processing & packaging
- As-built capturing for Architecture Engineering and Construction (AEC)
- Full-scale design visualisations in-situ
- Occupational Safety and Health awareness in manufacturing industry
- Work instruction delivery and performance tracking for maintenance and repair
- Plant layout design in manufacturing spaces

Another interesting solution is so-called “Assisted Reality” that puts information in a field service workers’ line of sight, but it doesn’t obstruct what they already see. With assisted reality, workers can see information from enterprise back-end data sources like text, diagrams, checklists and videos that were previously delivered on laptops, tablets and smartphones. The game changer with assisted reality is to do that with a “glance able” user interface and speech recognition so the workers can consume information in 2-4 sec and with hands-free user experience. That can increase first-time fix rates and reduce average repair times. Also, technicians can handle many

different types of service calls, so companies can better-utilize their existing workforce

In terms of optimization, SILO - one of our flagship solutions supports ongoing process optimization – the optimizer continuously gains knowledge about the process and uses the latest portions of knowledge that best correspond to the current operating point, so it is always well adapted to the current state of the installation (i.e. every 10 minutes a new model is created). The algorithm is inspired by immune systems and represents the state-of-the art of multiple input multiple output optimization approach which frankly speaking translates to simultaneous optimization of more than one aspect at the same time, i.e.: reduction of coal usage, reduction of CO emission, keeping a steam temperature at a certain level while increasing the boiler efficiency. The biggest breakthrough is that it allows for on-line self-learning which does not require changes in production schedules and identification experiments.

What are the examples of implementation in energy and manufacturing sectors?

a) predictive maintenance for coal mills in power plants with a goal to detect that an installation is in an atypical state, which may lead to a failure in the near future (or even indicate a malfunction). Every 5 seconds the algorithm collects data from DCS or SCADA system. The measured data characterize coal mill operation. Based on the collected data the modeled values of the mill motor current and outlet temperature are determined. The difference between modeled and measured values defines the diagnostic signal. For instance, we implemented such a prognostic intelligence for ongoing diagnosis of coal mills in Rybnik Power Plant (200 MW unit). We found that the solution can detect failures 30min in advance of mill overload, feeder clogging, lack of coal or coal suspension in silo

b) for machine building company in food & beverage processing industry we implemented an AR solution supporting after sales support teams with high quality training content and work-instructions delivery (technical product information for maintenance). With a combination



All major trends are focused on putting a human back into the loop.



of AR smart-glasses hardware and immersive AR software the machine builder can deliver added value services for complete product lifecycle and differentiate themselves from competitors

c) manufacturing space design in another interesting case can take advantage of Mixed Reality to deal with scanning the manufacturing area, taking measurements, arranging the space with machinery, designing installations, checking the ergonomics, visualizing hidden installations, creating operational procedures. Plant designers or facility layout planners wearing head mounted displays can analyze the current status of facilities by registering positions of equipment/installations, generated with CAD models and explore optimal spatial layouts options for manufacturing and production. This generates benefit opportunities not only in planning for installation of upgraded production lines but also in assessment of building renovation projects

d) plus, ongoing process optimization - SILO mentioned in the previous answer

Digitalisation and Co-operation in Process Automation

Urmo Sisask, CEO, Hyrles OÜ

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Hyrles OÜ specializes in producing thin sheet metal components. In accordance with customers' wishes, they make products at a competitive price and with stable quality. Close cooperation with customers – from designing the product and choosing suitable materials, up to guaranteeing the delivery schedules – creates a good basis for long-term cooperation with them. In production they use contemporary ERP systems, modern technologies and plan continuously to invest in the purchase of new equipment.

- Hyrles experience about co-operation in creating industry 4.0 revolution
 - Digitalisation effects to the process automation
 - Real time and integrated systems value in money for the Business
 - Integrated systems benefits for process management
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Personalised Manufacturing from an Automation Point of View

Dr. Björn Sautter, Research Cooperations Manager, Festo AG & Co. KG

Björn Sautter is responsible for strategic research cooperation at Festo, a leading global supplier of automation technology. He works closely with science and industry partners in the ManuFuture community and represents the industry side vis-à-vis the European Commission in the Public-Private Partnership board for Factories of the Future. Before he joined Festo in 2015, worked as EU project manager and strategic adviser at an international technology transfer and consulting enterprise. We asked Dr. Sautter to explain what the customer journey means to Festo in digital manufacturing and how does he see human-machine interaction in the future.

What does the customer journey mean to Festo in digital manufacturing?

Looking back at Festo's origins, our main business was and still is in providing automation solutions with pneumatic and electrical control and drive technology. Early on, our research department picked up on a new phenomenon: digitalisation. Important questions have been: How can we connect Festo's physical products with the digital world? And which new services can we provide for our customers?

Being involved in many Industry 4.0 activities has pushed us towards making our products more and more intelligent. For example, this year we have launched the first app-controlled valve that will develop into a "cyber-physical system" for digital pneumatics. That's the technological side of innovation. But the same goes for the digital customer journey. The internet becomes more and more important as a

contact point. We want to assist our customers in the digital world throughout the

whole lifecycle: from configuring the individual automation solution, to virtual commissioning, to maintaining and upgrading the operating system, and everything else that could fit into this chain of possible digital services. We're not there just yet, but are actively developing this side of our business. For example, our handling guide online is already moving in that direction. It's an intelligent engineering software that automatically works out suitable solutions, including downloadable CAD models and data sheets for our customers, and helps them to order a tailored handling system.

Moving on to production systems, Industry 4.0 stands strongly for agile manufacturing. How is Festo doing in this area?

We are still looking at a number of collaborative R&D as well as standardization requirements. Industry 4.0 is still a visionary concept, which we are now realizing step by step. In line with the increasing demand for customized products, future production systems will be more flexible

and adaptive to changing customers' needs. We will see more modular and intelligently networked production systems. To realize this scenario, we need e.g. interoperability standards for "plug & produce" capable components. The virtual representation and networking of manufacturing equipment will lead to a vertical and horizontal integration of production systems. The products themselves will become virtually represented, so that we will have integrated engineering for the whole product life cycle. Festo is active in all of these fields. In our new production plant, which we opened two years ago near our headquarters in Germany, several aspects of Industry 4.0 have become already a reality. By the way, it's interesting to note that there are still several manual working places in the assembly section for our customized products. It will be interesting to see how the relationship between man and machine will look in future production systems with respect to balancing the requirements of efficiency, flexibility and decent human work.

How do you see human-machine interaction in the future? What kind of skills will be required?

Looking at our new production plant, we already see an interesting mix of highly automated processes, manual working places and human robot cooperation in between. Intelligent assistance systems such as apps on mobile devices are used e.g. from our service engineers to detect and rectify machine faults as soon as possible and directly on-site. The human aspect is a very important issue from Festo's perspective. The factories of the future cannot exist without



Industry 4.0 is still a visionary concept, which we are now realising step by step.

humans. An interesting question is, what happens with the workers which are replaced by robots in the future? What will they do once they have been replaced? Most likely, they will handle the robots, which means they need to learn to control and operate them. Obviously digital skills will be needed and we can never forget the social and methodological aspects of our work. We all must be ready for continuous learning. My Festo teaching colleagues are already working on new ways of personalized and life-long learning.

Industry 4.0, Industrial Data Space and the Need for Transforming Manufacturing in Emerging Economies

Kay Matzner, Head of International Projects, Fraunhofer Institut for Factory Operation and Automation IFF

Kay Matzner is Head of International Projects for Fraunhofer Institute for Factory Operation and Automation. His work centres on international scientific policy and industrial cooperation and collaboration issues in thematic areas such as: Energy Consulting for Companies, Industry 4.0, Transport, Logistics, Information, and Communication Technologies. We asked Mr Matzner to explain the Industrial Data Space in the context of Industry 4.0 and to describe Fraunhofer IFF experiences from emerging markets.

Could you please explain the Industrial Data Space in the context of Industry 4.0?

The Industrie 4.0 concept is about the integration of cyber - physical systems. Therefore, Industrie 4.0 is roughly about optimizing effectiveness of physical manufacturing systems like robots through smart data usage. Logically, a manufacturer can better optimize effectiveness of its physical manufacturing systems, the more data it can access and use.

An opportunity to expand the amount of data a manufacturer can use is a deeper horizontal integration of global value chains by giving each partner access to data and therefore building an industrial dataspace. Building a global industrial data space may increase productivity for all participating partners.

To implement an Industrial data space, conceptual design and research works on a data reference architecture model meeting user requirements. Such user requirements are for example data sovereignty, decentralised data management, data economy, value creation, easy linkage of data, trust, secure data supply chain and data governance. The overall reference

architecture model that meets user requirements may therefore consist of the business architecture, the security architecture, the data service architecture and the software architecture.

What kind of productivity gains does data sharing enable in global supply chains?

In the literature, there are various analyses which predict a significant increase in productivity due to industry 4.0 and data sharing.

Productivity of manufacturers may increase by Industry 4.0 developments and data sharing due to improved planning possibilities, greater production flexibility, faster time to market of new product developments, improved product quality and more opportunities to customise production.

Please describe Fraunhofer IFF experiences from emerging markets.

To develop an optimal industrial dataspace, global partners in value chains also need to be appropriately qualified and upgraded to enable them to collect, provide and process the right data. Since such an upgrade implies productivity gains as well, some countries in emerging markets

recognized the need to support domestic companies by providing an appropriate innovation ecosystem. Fraunhofer IFF is working with government and non-government partners from China, Kazakhstan and Thailand on road mapping aspects to design such innovation ecosystems. Fraunhofer IFF also works with companies from those countries to develop individual Industry 4.0 strategies. Furthermore, Fraunhofer IFF is under contract to transfer technical Industry 4.0 solutions to those countries in the field of virtual development and robotics.



Building a global industrial data space may increase productivity for all participating partners.



Circular Economy and the Digilization of Industry: The FUTURING project



George Chryssolouris, Professor, Laboratory for Manufacturing Systems and Automation, University of Patras

George Chryssolouris is Professor (1993-) and was the Chairman between 2003 and 2007 in the Department of Mechanical Engineering and Aeronautics, University of Patras in Greece. He was, for 2006-2007, the President of CIRP, the Paris based leading International Academy for Production Engineering. He is a member of the High Level Group of the European Technology Platform on Manufacturing (Manufuture) and former Vice Chairman of the European Factories of the Future Research Association (EFFRA).

Professor Chryssolouris worked at MIT (Massachusetts Institute of Technology) in the USA between 1980 and 1993. He led a research group for the development of information systems and automation for industrial applications. He taught at MIT undergraduate and graduate level subjects related to manufacturing, systems, design and automation. He worked (1976-1980) as a research associate at the Institute of Manufacturing Technology and Machine Tools at the University of Hannover in Germany.

Professor Chryssolouris has more than 400 publications in international scientific journals and refereed conferences. He is the author of two books published by Springer Verlag. He was granted the Frederick W. Taylor Research Medal by SME (2001) for his outstanding contributions to manufacturing research. He was also the recipient of SME/s Young Outstanding Manufacturing Engineer Award (1986).

- The three “Re-” pillars of manufacturing in the context of circular economy: Re-use, Re-manufacturing and Re-cycling
- Digital manufacturing as an enabler for circular economy
- Production processes and product development in the context of circular economy in digital manufacturing

Exploring University-Business Partnerships and Identifying the Best Fit to Maximise Research Impact.

Renno Veinthal, Professor, Vice-Rector for Research, Tallinn University of Technology

Renno Veinthal is a professor of composite materials at the Department of Materials Engineering at Tallinn University of Technology (TTÜ). In September 2015 Prof. Veinthal became a Vice-Rector for Research at the same university. His main research interests are related to different multiphase materials and coatings, materials for aggressive environments and various wear applications (erosion, abrasion, fatigue and impact wear) and development of test methods for wear characterization. His recent research portfolio includes development of production technologies for RE based magnetic materials, novel manufacturing methods applied in powder metallurgy (additive manufacturing methods, spark-plasma sintering, reactive sintering), development of wear parts for tunnelling applications, multi-scale structured ceramic-based composites for extreme applications etc. He has been active as a co-organizer or member of several international conferences in materials engineering Baltmattrib, DAAAM, AMM etc. Estonia has a history of conducting exceptional research. However, translating this into economic growth appears to be a fracture point. Mr Veinthal's presentation will explore how commercial entities and universities can collaborate for better research translation. Building long-term partnerships between universities and end users, including industry, government and not-for-profit, is critical mostly for the parties involved but also the society at large.

What University-Business collaboration models that have been effective/ineffective?

The university started an innovation and business centre Mektory™ few years ago in order to develop and provide a systematic support system for commercialization of research. The concept of Mektory was developed following the international best-practice and turned out to be the best-practice also for Estonia. Mektory brings together entrepreneurs, scientists, students, professors, schoolchildren and investors to generate innovative ideas and bring them to life as a team. One of the recent and successful initiatives is TTÜ Mektory Youth Entrepreneurship Ecosystem, which includes a youth program "Bright Minds", pre-incubation program "STARTERtech",

startup competitions and incubation activities, such as opportunities to meet and get introduced to investors, funds, and international delegations. Strengthening the capacity for young people to gain entrepreneurial competencies will create an enabling environment, build an entrepreneurial culture among young people and prepare them to adapt for jobs that do not yet exist. Estonian universities hold only a few shares in the firms, which are mostly R&D development centres or firms offering ancillary services to universities. Thus, there are few examples of classical spin-off ventures. The entrepreneurial activeness (i.e. at least one share in one firm) of university academic personnel (researchers, senior researchers, assistant, associate and full professors) varies

remarkably through Estonian public universities but is highest at TTÜ.

How to find a common ground and aligning the major drivers for both partners?

TTÜ has established a set of initiatives for promoting and building trust in university-business partnerships. This includes a network of faculty based TTO's, support system for prototyping, advisory services for early-stage entrepreneurs, advisory services for IP protection, use of infrastructure, and providing various testing and research services for companies. In fact, the most important field of commercialization for Estonian universities is still offering research services to firms. This is encouraged recently by a national support scheme, making this scheme economically more attractive for public universities and other R&D organizations than ever before.

How to build and maintain effective communication channels?

The innovation actors must have strong links with each other based on a strong level of trust. The quality of relationships, attitudes and behaviours can be seen as a pre-requisite for successful innovation systems. A cultural gap between partners prevents trust building, which is a prerequisite for long term relationships benefiting all partners. Participation in regional networking organizations and also the presence of professional technology-transfer officers (TTOs) facilitates the process of good understanding between partners, bridge the cultural gaps, and as a result increase interaction and enhance levels of trust.

What are the major collaborative support programmes and how to access them?

The major collaborative support programme in Estonia is called "NUTIKAS"- Smart . This program is designed to support applied research in smart specialisation growth areas. The support aims to contribute to growth in the research-intensity of the Estonian economy, supporting collaboration between R&D institutions and companies. Furthermore, the support will help



The innovation actors must have strong links with each other based on a strong level of trust.

to raise the capabilities of R&D institutions to carry out applied research needed for business in smart specialisation growth areas. The volume of funding in a call for proposals is up to 9 million euros, the maximum volume of funding per project is 2 million euros, whereas the minimum amount is 20 thousand euros. The company contributes to the study with its own financing depending on the size of the company, and whether product development or an applied study is involved. Funding is applied through open calls for proposals organised by the national agency. The companies are expected to take more responsibility for implementation of the research results and have a clear strategy for commercialization of the results. The universities have developed a joint portal called ADAPTER. It is a virtual one-stop-shop that enables everybody to present an inquiry to Estonian research and development institutions, search our database for all the services on offer by those facilities, study the support mechanisms for companies to be engaged in engage in research and development cooperation.

How Can Europe Increase the Impact of RDI-investments via P4.0?

Dr. Harri Kulmala, CEO, DIMECC Oy

In 2008, Harri Kulmala started as the CEO of FIMECC Ltd., which was the primary platform for pre-competitive research in Finnish manufacturing industries until 2016. FIMECC was the 1st high-volume industry-driven PPP implemented in the EU. We asked Dr Kulmala How PPPs can be enlarged towards P4.0 and what makes DIMECC's P4.0 platform special compared to other similar platforms in Europe.

Can you please talk us through the term P4.0?

P4.0 comes from 4 different words starting with the letter 'p': public, private, people and partnership. It's an addition to the concept of public private partnership – the format in which Europe has carried out more and more research development and innovation initiatives and activities. This fourth 'p' comes from the word 'people' referring to individual citizens who can be mobilised and activated in work innovation (even though as citizens they don't have the chance to invest in research, development, and innovation like organizations have). Europe is enlarging and enriching the concept of public private partnership (PPP) towards individual citizens. P4.0 was originally developed within the Finnish technology industries and is a crucial part of digital transformation. Now traditional PPPs are combining with the 4th digital revolution into a single concept.

DIMECC has created its own P4.0 platform. What makes it special compared to other similar platforms in Europe?

DIMECC is a continuous ecosystem for

creating innovation. It's not a project nor a program. It's a complete innovation ecosystem where we combine relevancy and commercial interests with the competence and knowledge available at research institutions. We have an impactful structure and mechanisms for gathering commercial people and the academia to discuss and design the future together. It's not about studying the possible scenarios, it's a question of defining the Future by ourselves. Our method is co-creation. This has proven to be very effective. Year by year we are able to measure the business potential amongst our commercial customers. The potential seems huge. It's 20-fold compared to the investment made in our ecosystem. DIMECC is one of the most effective innovation platforms in Europe.

One Sea ecosystem – can you elaborate a bit on this case?

According to our vision autonomous ships will be sailing in the Baltic Sea region by 2025. There are many marine industry companies involved. The biggest players are for example Rolls-Royce, Ericsson, Cargotec, ABB - global companies with significant operations in the Baltic Sea region.

The challenge here is not technological. The technology is already there. The question is much bigger: Can we have an open sea between many countries which is totally operated by autonomous ships? We need to consider business interests, legislation as well as human behaviour/culture. Yesterday we received a lot of publicity in Finnish, German and British newspapers. The first ever globally open test area 'Jaakonmeri' was opened near the west coast of Finland. It follows the P4.0 idea of being open to everyone.

How would you fill the gap between the PPPs we know today and the P4.0 concept?

PPPs have a wide variety of structures in different countries all around Europe. If we think about individual citizens, venture capital and start-up companies, they call for faster implementations, more flexibility in operations, less bureaucracy etc. Traditional PPPs (no matter how good they already are) can be enlarged towards P4.0 by improving them in the listed areas. I would recommend taking the best private sector driven PPPs to start with. Build on the good experiences and enlarge them with a systemic approach. If P4.0 is started from zero or with public sector leadership, then



It's not about studying the possible scenarios, it's a question of defining the Future ourselves.

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we are faced with possibly too long lead times to achieve results.

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The Digitalisation of Manufacturing: Challenges and Opportunities for European Advanced Manufacturing



Filip Geerts, Director General, CECIMO – European Association of the Machine Tool Industries

Mr. Geerts is Secretary General of CECIMO since 2008. He is a professional in EU public and regulatory affairs with long-standing and extensive experience in the management of companies, national and EU trade associations. Mr. Geerts was previously Deputy Director for the largest Belgian association for the technological industry, FITCE. He was also public and regulatory affairs manager for IBM Europe, Middle East and Africa as well as Secretary General for numerous European trade associations dealing with manufacturing and the engineering sector. A commercial engineer, Mr. Geerts obtained further degrees in EU economic policy, law as well as financial and business management from Insead Fontainebleau and Singapore, London School of Economics, Vlerick, College of Europe, The Catholic University of Louvain-la-Neuve and the Catholic University of Leuven.

- Shifting from incremental to disruptive innovation
- Transformation from machine supplier to manufacturing process partner
- Developing data-driven solutions together with customers
- Policy action to support this change

Turning Data into Business Value with MindSphere IoT

Ilmari Veijola, Service Manager, Plant Data Services, Siemens Osakeyhtiö

Mr. Ilmari Veijola (M. Sc. Process Engineering) has extensive experience in the execution, management and development of various value based engineering solutions and services for the industrial sector globally. In his current position as the Head of Sales, Data Services within Siemens Osakeyhtiö since February 2016, he is responsible for Siemens' MindSphere IoT deployment and related digital service development in Finland and the Baltic regions.

- Open, cloud-based, IoT operating system
- Refining data into business value
- Closing the loop of a digital value chain



On the Way to Industrie 4.0: Driving the Digital Enterprise



Jan Michael Mrosik, CEO, Siemens Digital Factory

Dr. Jan Mrosik has been Chief Executive Officer of the Siemens Digital Factory Division since June 2016. Jan Mrosik, who holds a doctorate in electrical and industrial engineering, has served Siemens in a variety of capacities over the last 20 years. He began his Siemens career at Information and Communication Networks (ICN) in 1996. In 1998, he took over the responsibility for the Siemens Communications business with Vodafone D2. In 2002, Mrosik transferred to Siemens Telecommunications Pty (Ltd) in South Africa, where he was responsible for the communications business of Siemens in Southern Africa. Between 2007 and 2016, Jan Mrosik held various management roles within the company's energy department, including being CEO of Energy Automation, Smart Grid and Power Transmission. Prior to his current role, Jan Mrosik was CEO of the Energy Management Division of Siemens AG.

Digitalisation changes everything. It changes the way we stay informed, the way we travel, the way we buy things. Besides our private lives, digitalisation is also disrupting business. As the world becomes increasingly connected, digitalisation is becoming the key differentiator that will enable companies to remain competitive. With the Digital Enterprise Suite, Siemens has created the market's most comprehensive portfolio of software-based systems and world-leading automation technologies. By using digital twins of product, production and performance, the company is bringing together the virtual with the real world, based on a common integrated data model and connected by MindSphere, the cloud-based, open IoT operating system. This offering helps manufacturing companies from the discrete industry to master their digital transformation, thus securing their future competitiveness.

How ICT Innovations Add to Efficiency in the Energy Sector - the Experience of Estonian Energy Companies.

Hando Sutter, Chairman of the Management Board, Eesti Energia

Hando Sutter has been Chairman of Management Board and Chief Executive Officer of Eesti Energia AS since December 2014. We asked Mr Sutter about how Eesti Energia makes the production processes of the oil shale industry more efficient through the digitalisation process and how smart grid and smart metering influence business.

Eesti Energia has clearly embraced digitalisation as the path to the future. What have been the most interesting experiences and developments around digitalisation in recent years?

We should start by looking at the energy market on a broader scale. Eesti Energia was a fully regulated company just a couple of years ago. Our cost base was regulated meaning that in case of financial shortage we were forced to raise our tariffs. We are now working in a very competitive market. Grid business remains regulated, but is also moving towards this high competitiveness. Here, technology comes into play because in order to survive and be successful – we need to be innovative. For us at Eesti Energia, digitalisation is the key to winning this battle.

Smart grid and smart metering have been outlined numerous times in previous discussions. Can you talk us through the importance of these two?

Four years ago, Estonia made a very brave decision: a 100% rollout to smart metering. This project was finished at the end of 2016. Estonia is probably the only country in the world to have 100% smart metering. All our consumers, from

industrial to households, can use hourly prices from the market. This is the base for further smart services in the power market. Without smart metering, these good ideas can't be utilised. We now have the necessary infrastructure to make this world a better place for our customers.

Given that this powerful infrastructure is now in place. How does it affect your business and what kind of innovations can we expect in energy production?

Regarding the smart grid system, we already have some encouraging results, which hopefully will inspire others to move in the same direction.

We've seen a 50% decrease in customer contacts meaning that we are significantly cutting our costs by handling less contacts. At the same time, customer satisfaction has doubled. Costs are down and customer happiness is up!

Big data and digitalisation are major topics in energy generation. From planning to distribution, we are really rethinking all our business processes with these two factors in mind. Our new power station is the biggest single investment in Estonia's history (640 million euros). The new power station comes with 10,000 sensors which means 10,000 different information lines coming in from

the station. Using this data smartly will give us endless possibilities to work more efficiently and be proactive with maintenance issues.

Looking at the nearest future, where is Eesti Energia heading in terms of digitalisation?

The energy sector is moving away from asset-based thinking and transitioning to the world of big data. Data is creating value. Customer happiness, asset utilisation, the right investments – everything depends on the kind of data we have and how smartly we use it. Eesti Energia is currently working in this area and we have clear targets to reach.

Moreover, as we are a step ahead compared to our colleagues in other countries, we have an opportunity to share our experiences and maybe even earn some money by introducing our solutions to others.



Estonia is probably the only country in the world to have 100% smart metering.

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Innovation Collaboration Between Start-ups and Established Players



Lauri Väin, VP of Engineering, Starship Technologies

Lauri is running Starship's engineering troops on daily basis. An experienced tech industry executive, he has been working for years for Skype, Microsoft and Ericsson.

- Design of smart robotic systems across hardware and software
- Successful collaboration between startups and established players
- How to use agile methodologies in partnerships

Factories of the Future – Manufacturing in Horizon 2020 and Beyond

Dr. Gustaf Winroth, Research Programme Officer, European Commission

Dr. Gustaf Winroth works at the European Commission, Directorate-General for Research and Innovation. We asked Dr. Winroth about the current status of FoF and what might be the first steps towards getting more involved for the audience members interested in learning more about FoF initiatives.

Could you explain the meaning behind these abbreviations: FP7, H2020, PPPs, cPPPs, and FoF?

We do have quite a few abbreviations but it helps us to refer to all the initiatives that we are currently implementing. If we start from the framework programmes, FP7 stands for the Seventh Framework Programme. The current framework programme is Horizon 2020 (H2020) which is running calls between 2014 – 2020. The projects will continue beyond these dates, but new calls will no longer be launched after 2020. The majority of EU level research programmes are located under these framework programmes.

Under H2020, the projects under the Industry Pillar (also known as 'Industrial Leadership') are meant to engage with the industry. One way to do that is via public-private partnerships (PPPs), which in turn divide into two forms. The first way is using the joint technology initiatives that are institutionalised PPPs implemented through an external entity. The second form is through the contractual partnerships (cPPPs). This is where Factories of the Future (FoF) comes into play. FoF's initial aim was to respond to the financial crisis, within the manufacturing industries. It's a direct instrument for targeting industry and industrial involvement in R&D. Upon entering

H2020 the success of our first cPPPs enabled the establishing of more contractual arrangements with other industrial sectors. Today there are ten cPPPs, including FoF. The private side is represented by an industrial association. This association plots priorities through a roadmap and a strategic research and innovation agenda. These priorities are linked with the EU policy priorities as well as the strategic agendas of the Member States. The final outcome of the process is a set of topics under H2020 to which people can submit proposals for funding.

What is the current status of FoF?

FoF was already a part of FP7 hence H2020 is an extension of that. Most of the projects running under FP7 have now ended, or are coming to an end. We can already see what will happen at the end and identify the added value and industrial uptake of their results. We are now three years into our cPPPs under H2020. Currently a mid-term review is running of all the cPPPs that launched calls between 2014 and 2016. We have 9 cPPPs in total that are subject to the review. There is a tenth cPPP on cybersecurity but they have not launched any calls within the above-mentioned timeframe. A group of independent experts are studying the performance, impact and

relevance of these cPPPs in the wider perspective of H2020. FoF is one of the more mature PPPs because it was already a part of FP7. We can compare previous results with those coming out from current projects. Some trends can already be pointed out here.

It is planned that the last work programme of H2020 will be published by October, which would span the calls between 2018 and 2020. We're looking at three important years where we can further demonstrate the capacities and the potential of FoF.

Do you have any practical examples based on this mid-term review you are currently conducting?

In my presentation at the Manufuture 2017 conference I will provide some examples. We do have a mix of different types of projects. Projects that are working at the lower technology readiness level where it's about taking something on a proof of concept level and elevating it towards something that can be commercialised and exploited in industry.

Then we have other projects that are working in a more advanced setting at a higher technology readiness level. Here, the focus is more on the innovation aspects and the industrial demonstration is important. FoF projects are good examples of these activities. There are many projects with good examples on how this works in an industrial setting.

Have you managed to spot the challenges faced by public-private partnerships?

It's very important that the cPPP stays relevant in terms of the industry's and European priorities. We also need to respect our member states and their interests. Meanwhile flexibility comes into play because technology evolves at a rapid pace. H2020 launches calls over 7 years and we need to be able to respond to new innovations when they occur. In addition, as a part of H2020, we are really trying to reduce the time between the call and awarding the grants. Our legal target is 8



We're looking towards three important years where we can further demonstrate the capacities and the potential of FoF.

months, but we are constantly getting faster than this throughout our Industry Pillar. We are trying to be as fast as possible.

For the audience members interested in learning more about your initiatives, what could be the first steps to getting more involved?

The good thing about FoF and our cPPPs is that they are open to anyone who is eligible for H2020 funding. As an example, the participation rate in FoF of non-members of the association is reported to be 77% in our recent Horizon 2020 Interim evaluation. The first step would be to approach the association and become part of their mailing list for activities. You can also take part in our information days, which are organized across EU through national contact points (NCP). You will find them in every EU country and in the countries associated to us in H2020. These contact persons are very knowledgeable and can help you to take the first steps towards engagement.

Estonian Case Study About Product Innovation Through Clustering

Helena Almqvist, Managing Director, Protex Balti

Helena Almqvist is the Managing Director of Protex Balti AS, a leading provider of advanced textile solutions to the Scandinavian market. The company is a subsidiary of Protex AS (Norway) and currently employs 230 people in Tallinn and Pärnu. Today the Protex technical / smart portfolio is growing rapidly and represents 49 % of total turnover. The company also has strong partnerships with several prestigious research institutes and innovative start-ups. Helena started her career in Protex as Chief Business Development Officer in 2012, implementing a broad restructuring of the business portfolio towards high profile technical customers. We asked Ms Almqvist to explain the Protex story

Could you please explain the background and the story of Protex?

Protex entered the Estonian market in 2007 through acquisitions. Between 2007-2011, Protex acquired six major textile companies in Estonia. This made Protex Balti one of the fastest growing companies in Estonia during this period (Äripäev). Some of the companies acquired had severe financial problems and consequently, the company suffered heavy losses.

To turn the financials around, Protex started in 2014 to re-direct its business portfolio towards high technical profile customers and to cooperate with prestigious research institutes (www.sintef.no) and innovative start ups. In 2015, Protex launched its own brand Ragnarok (www.ragnarok.as) – providing tailor made work clothing for the maritime industry. Currently, Protex has a full-time manager and a show room in Trondheim, Norway. Reference customers: Leroy (www.leroyseafood.com), Marine Harvest (www.marineharvest.com) Other segments: Environment (www.oceanvisuals.no).

Today, the Norwegian owners are very satisfied with their investment. Since 2014, Protex has shown increased turnover and profitability year on year. The technical / smart portfolio is fast-growing and today represents 49 % of total portfolio in turnover.

In autumn 2016, Protex started preparatory work for Ragnarok 2.0, an upgraded version and smarter version of the already existing work wear collection.

Around the same time, the Estonian ICT Cluster were looking for partners for a cross-sectoral smart product pilot project. Protex was invited as the representative of the textile industry and in addition to ICT companies, Smart Electronics Cluster ESTRONICS companies and Tallinn Technical University who were also included in the consortium. The outcome is a truly revolutionary, smart suit prototype – Ragnarok 2.0.

Regional Collaborative Innovation for Meeting Global Manufacturing Challenges

Enrico Callegati, R&D Funding Manager, CRIT

Enrico Callegati works for CRIT, a technology brokerage company belonging to a cluster of large manufacturers located in Italy, where he is responsible for all activities related to R&D funding. We asked Mr Callegati about CRIT and his vision for the future and digitalisation.

Can you talk us through CRIT's history? What's your story and what are your goals?

CRIT is a technology consulting company owned by 27 large industrial manufacturing corporations originating mainly from Emilia Romagna, a region heavily focused on mechatronics. CRIT's stakeholders are world-renowned companies such as CNH Industrial, Ferrari, Tetra Pak as well as famous names from the motorsports, packaging and agriculture machinery sectors. Our company was founded over 15 years ago when a group of entrepreneurs realised that they could somehow leverage the skills of their region. Hence, they came together to set up a new company which would act as a knowledge sharing hub. Everyone wanted to get a peek at the R&D departments in other companies. They found they were encountering the same problems. As they were all delivering solutions to different markets there was no conflict of interest. Today our role is to accelerate the innovation process in manufacturing companies and we believe that companies can really benefit from regional collaboration networks and hence become more prepared for the Industry 4.0 revolution.

Moving to the Factory of the Future impact project, how is it coming along and what have you learned?

The project kicked off in 2015 and was originally coordinated by EFFRA (European Factories of the Future Research Association). We had two years to collectively study, interview and analyse the information regarding what we call the Success Factors of collaborative funded projects. We're talking about the elements that were positively influencing the odds of projects to be successful in terms of market impact. The results delivered through this project were turned into real products and services. By leveraging our network's experience, we were able to identify some important aspects such as the importance of directly knowledge of an industrial community (i.e. speaking their own language, high levels of trust with key R&D managers...) before trying to engage them in a technology transfer process. Horizon 2020 projects are usually designed with the aim of resolving European manufacturing challenges. The issues come when organizations/businesses are ready to launch their innovations. Now the broad European-level challenge needs to be translated into local context because manufacturing companies (customers) are looking for clearly expressed answers. Everything is

scaled back to simple communication. How can we effectively communicate research results in view of achieving technology transfer among factories?

What is your vision for the future? How will you pursue digitalisation in a regional manufacturing context?

Here we have several things to consider. What has become more and more clear amongst all the hype: this is the first revolution that has been announced before actually taking place. It's a paradox. Most technology suppliers agree that companies should have a gradual approach to digitalisation. Start by identifying one issue which could be solved in an innovative way. Something where the impact can be easily measured. If this works then you can continue to expand this approach to other business fields and domains. The gradual approach has a positive effect because if a single company has good results then it can be spread out amongst other companies. Others can make investments based on the knowledge of the whole community.

There is another strategic issue regarding the purchasing of digitalisation infrastructures. Manufacturing companies find it hard, because once the decision is made it becomes somewhat irreversible. There is this vendor lock-in -effect, if you make one investment with one provider then it becomes very costly to stop relations and switch to another supplier that maybe has a more suitable solution for your business. Regional knowledge exchange networks can be very helpful here and provide guidance during these important decisions.

Digitalisation will bring along the demand for new services for manufacturing companies, which in turn requires innovative business models. There



This is the first revolution that has been announced before actually taking place.

is a tendency to speak about digitalisation in a very enthusiastic and non-critical way, but there are actually many risks. The higher risk is probably making huge investments in digital platforms and strategic consulting in I4.0, without being able to reap the benefits from it. This may be due to several aspects (enterprise culture, workforce skills, value chain readiness, regulatory aspects...), and it can bring in severe financial drawbacks for a mid-sized manufacturing companies. New services, conceived through an I4.0-based business model framework, need to help companies meet such challenges, and leverage the full potential of I4.0 technologies.

Renewable Energy: How You Can Save and Make Money

Vidmantas Janulevičius, Chairman of the Board, Global BOD Group

Vidmantas Janulevičius is the Chairman of the Board at Global BOD Group. He has worked for UAB Solitek cells, UAB BOD Group and UAB Baltic Optical Disc. He became interested in solar cell manufacturing facilities in Lithuania in 2008 and today is in constant contact with the solar cell production lines suppliers, coordinating the signing of contracts with vendors, participating in negotiations and monitoring production lines in the acquisition process. We asked Mr Janulevičius to talk about Global BOD Group.

In a nutshell, what is it that you do at Global BOD Group?

Global BOD Group is a private company based in Latvia. In general, we have three business directions: production of optical disks, production of solar cells and solar panels and production of ophthalmic lenses (production of glasses for retail opticians and professionals across the EU). Now if we connect this to Industry 4.0, the latter is completely digitalised. Everything from receiving prescription data to producing the actual lenses is done online. Our solar energy branch is also moving in that direction.

In regards to Industry 4.0 principles, what are your plans for the future?

Our goal is to be as close as possible to the end consumer. Digitalisation enables us to do just that. No matter what business branch we're talking about. It can be a construction company doing facades or energy distribution company needing solar technology – moving our processes online allows us to reduce costs and be closer to the end user.

What kind of obstacles have you encountered in fulfilling those plans?

Finding and renewing my current work force. By now my management team on average 35 years old, which by no means is old, but all this technology requires a different mind-set. It's hard for me too. So unfortunately, I'm forced to change my management team. I'm trying to be a front-runner in terms of the latest technology and the opportunities it offers, meaning that I'm constantly learning new things. These changes in the industry allow us to reduce costs, save time and increase efficiency, but for the older workers, it's hard to adopt this new way of thinking and learn modern systems. Many of them will lose their jobs. Automation is moving forward, machines are becoming smarter, things can be produced without a click of a button. The computer is much more precise than the human, hence we need people who can work in this environment.

If we're talking about changing your key personnel, where do you find skilled workers? Are you looking at the international employment market or trying to stick to the Baltics?

Bringing people in from the outside is very expensive. We're mostly scouting for people from Baltic universities. In the past, it was much harder. We actually considered sending local students to German universities to finalise their theses and top-up their skills. The tricky part is giving the right training and making sure that they return home. I believe it's possible to stay and work in your home country. Back in the day, when we just started with our lens production, we didn't have any expertise around. Therefore, we employed six people from Germany, France and Belgium to train our staff and show them how to work with modern equipment. We gave a 1-year contract.

The latest industrial revolution, the newest technology, platforms and programs that come along with it are a huge opportunity to receive funding and tell about your projects worldwide. If somebody finds it interesting, a lot of doors can open up and products at good prices will hit the market. You'll find quicker financing possibilities, be smarter and much faster compared to the old times.



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Developments in Manufacturing Technologies Research and Co-operation between Riga Technical University and CERN

Toms Torims, Scientific Associate, CERN

Toms Torims has masters degrees in mechanical engineering (2001) and in social science (2003). He holds a PhD degree in engineering sciences from Riga Technical University – RTU (2006). He started his professional career in 1994 as a Technologist in a ship repair enterprise. Subsequently, he became an Engineer and the Managing Director of a ship repair company. He continued his career in the public administration sector and worked for more than 10 years in the European Commission, where the last assignment he held was Maritime Security Inspector in the DG for Mobility and Transport. Since 2006 he has been on the RTU academic staff and was elected Full Professor, where he is continuing his research and teaching activities. He is author of some 50 scientific articles and co-author of 5 university textbooks. Prof. Torims is Advisor to the rector of RTU, Advisor to the Minister of Education and since and sine 2017, Scientific Associate at CERN. He heads the RTU Centre of High Energy Physics and Accelerator Technologies. We asked Mr Torims about the latest developments in area of additive manufacturing.

What are the latest developments in area of additive manufacturing?

Over past last decade, additive manufacturing has received a lot more focus in manufacturing and engineering. Technology for prototyping is no longer considered as something exclusive and expensive. It's part of the normal agenda in many manufacturing enterprises which are now able to purchase this technology. You can compare additive manufacturing with computers, which used to be very expensive and are now available to the vast majority. However, there is a lot of technological and scientific optimisation we need to overcome in order to use it in daily manufacturing. Is it possible to make it more reliable, compact, cheaper and prognosable so we can estimate the results from our manufacturing processes? Scientist and engineers in the area of additive manufacturing are responsible for finding answers to these questions and there are a wide

range of sub-technologies we need to understand.

There is wide interest in additive manufacturing. Prototyping businesses, universities and many others are counting on these tools, because they're already commercially available. RTU and CERN are working on how to apply this technology for unconventional applications.

How would you describe RTU's collaboration with CERN? What does it entail?

RTU and CERN have had a collaboration agreement since 2012. Our first projects can be tracked back into 1998, but these past five years have brought us closer together. This new agreement creates a framework for us, but it doesn't set any boundaries in terms of what we do. It's a strategic partnership for both parties. For RTU it allows us to boost disciplines in our research and technology areas. It's also very much about particle physics, which is a strong focus for

CERN.

Every year, 20-25 of RTU's students are sent to CERN to learn about the organization and the work they're doing. It's very beneficial, because people come back with a different perspective. CERN lecturers are also happy visit RTU regularly. CERN organises summer schools on different subjects, which are very popular amongst our students. They can learn from the best scientists of the world. Moreover, we're working on the same projects, one of which is an EU-funded CERN project called ARIES focusing on developing technologies for future accelerators. Currently, two of our PHD students are doing research in CERN. One in particle physics and the other in robotics.

When it comes to myself, I'm also doing some research for CERN regarding the technologies they have available and their possible application in daily life. It's like an overview of what is there for the Industry and business. There are a lot of marvellous technologies, which are just sitting there. For example, how could we clean exhaust fumes from ships using particle accelerators. It's quite interesting!

Latvia as a country has had an agreement with CERN since 2013. Latvia is moving towards



becoming a CERN associate and a full member state of CERN. Estonia is also looking forward to that.

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Use-It-Wisely: Innovative Continuous Upgrades of High Investment Product-Services



Riikka Virkkunen, Research manager, VTT Technical Research Center of Finland Ltd.

Riikka Virkkunen’s main responsibilities at VTT are the preparation of the Industrial Renewal strategy and boosting activities in European research (Factories of the Future, ICT). Previously, she worked as Head of research area System Engineering, leading a hundred-twenty-experts-strong department with a significant international portfolio. Before that, she was Technology manager in Systems engineering and Group leader in Simulation and virtual modeling. Since 2017, Virkkunen is coordinating the activities of FIIF, Finnish Industrial Internet Forum, with ca. 250 member organizations of which about 200 are companies. She is also heavily involved in the Digitalizing European Industries (DEI) discussion, in European Factories of the Future Association (EFFRA) and a member of the Factories of the Future partnership board. Virkkunen holds a PhD in computational materials physics.

- New business models, tools and applications which extend the lifespan of industrial products
- Knowledge sharing across six distinctive industries
- Development and improved use of technologies
- Principles of Circular Economy

CxMan: Computer Aided Technologies for Additive Manufacturing

Dr. Georg Muntingh, Research Scientist, SINTEF Digital / Quality Assurance Coordinator, CxMan project

As a Research Scientist at SINTEF Digital, Georg Muntingh is currently the Quality Assurance Coordinator for the Factories of the Future project CxMan: Computer-aided technologies for additive manufacturing. Previously he worked as Core Management member of the Factories of the Future project CloudFlow, which concerned engineering workflows in the cloud for manufacturing industries. Georg Muntingh holds a PhD degree in mathematics (2011, University of Oslo), and worked from 2011 to 2015 as a Postdoctoral Researcher on various topics in geometric modelling at the Centre of Mathematics for Applications and at SINTEF.

- Cloud services and algorithms for AM
- Trivariate representation for AM
- Standardization



FORTAPE: Research on Efficient Integrated Systems for the Manufacturing of Complex Parts Based on Unidirectional Tapes for the Automotive And Aeronautical Industries

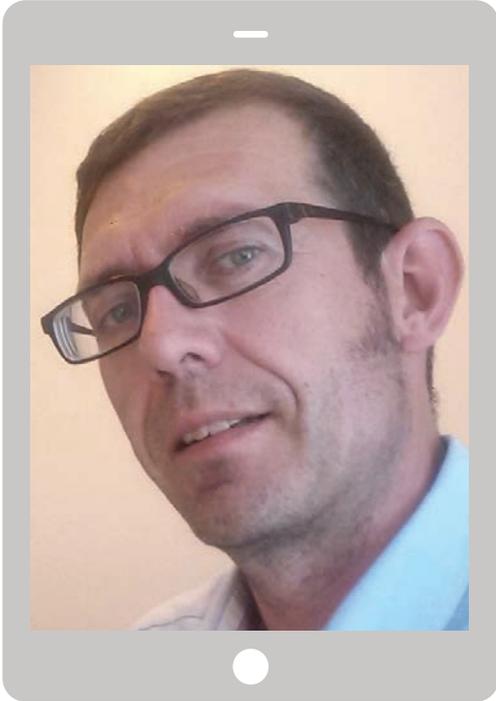


Raquel Ledo, Head of Materials Innovation Area, CTAG - Automotive Technology Centre of Galicia

Raquel Ledo has a MSc in Telecommunication Engineering by the University of Vigo with a degree of Research Proficiency and Advanced Studies and a Master in Automobile Enterprises Management by the University of Vigo. With more than 13 years of experience, she is currently working as Head of the Materials Innovation Area in CTAG (Automotive Technology Centre of Galicia). Before joining CTAG, Raquel worked as a Continuous Improvement and Development Manager in Prevent Vigo S.A., a textile seat covers automobile supplier, and afterwards she worked in PSA Peugeot Citroën France and Spain as Assistant Body-in-White Manager, coincident with the launch of Citroën C4 Picasso and Citroën Berlingo/Peugeot Partner. Last 9 years Raquel has used her project management experience for R&D project management in CTAG. She has been directly involved in more than 10 EU projects, 3 of them within 7FP and 4 of them in H2020, and she is the coordinator of FORTAPE project (H2020-FoF) and Expert Evaluator in H2020 – SME Instrument and other programs.

- Use of UD tapes in automotive and aeronautical sectors
- Innovations in FORTAPE project
- Expected impact

ConnectedFactories: Industrial Scenarios for Connected Factories



Chris Decubber, Technical Director, EFFRA

After obtaining his master of electro-mechanical engineering at the University of Leuven, Chris got involved fairly quickly in European research and innovation programmes. At EFFRA, Chris Decubber aims at generating consensus on research and innovation priorities among the industrial and research community for the 'Factories of the Future' PPP. Chris is coordination the monitoring of the outcome and progress of the 'Factories of the Future' PPP and works on knowledge transfer mechanisms that enhance the impact of the FoF PPP. Chris also coordinates the ConnectedFactories Coordination Action which focuses on the stimulating the digitalisation of manufacturing.

HUMAN: Human-Centred Manufacturing

Manuel Oliveira, Senior research scientist,
SINTEF

Manuel Fradinho Oliveira is senior research scientist at Sintef. His research interests include learning, social media, serious games, user engagement, gamification, user behaviour change, virtual environments, and mixed reality. He has more than 100 refereed conference and journal publications to date. He founded HighSkillz in 2012, a start-up specializing in rapid competence development using serious games and gamification. He is working on the use of serious games, simulation and virtual reality in attracting young talent to manufacturing education.

- Co-creation of manufacturing solutions
- Adaptive manufacturing workplaces to human cognitive and physical skills
- Digital enhanced operators



CTC Project - Local Flexible Manufacturing of Green Personalized Furniture Close to the Customer in Time, Space and Cost



Giuseppe Lucisano, Coordinator of Innovation and R&D, SCM Group

After graduating Bologna University in Mechanical Engineering Giuseppe Lucisano worked in Aetna Group R&D. Since 2001, he has been member of the managerial team for the coordination and funding of Innovation of SCM Group. In that role, he organized and managed several R&D cooperation projects on local, national and international level within Eureka! Framework, FP7 and H2020. He is President of the Regional Platform "ER.Amiat - Emilia Romagna - Advanced Mechanics and Industrial Automation Technology" since 2014. He is "Independent expert" for the evaluation of research and innovation projects promoted by the European Commission since 2011. He has been member of the "Expert Committee" of the Coordinating Action PROsumer.NET financed by the EC in the FP7 NMP programme; member of the "Advisory Board" of the Project "PRIME - Plug and Produce intelligent Multi-agent Environment based on Standard Technology funded by the EC in the P7.FOF.NMP.2012-3; member of the "Advisory Board" of the Project "Pathfinder - Pointing the way to the future of manufacturing" financed by the EC in the FP7-2013-NMP-ICT-FOF; elected member of the board of the Cluster Tecnologico Nazionale Fabbrica Intelligente from 2014. He is holding intellectual property of several patents.

- Customized low cost products
- A new Production System Model - Factory in the Mall
- Desing to manufacturing
- Local integrated supply chain

Digital4Industry in the UK

Dr. Lina Huertas, Head of Technology Strategy for Digital Manufacturing, Manufacturing Technology Centre

Lina Huertas is a chartered engineer with significant experience in defining, framing, developing and demonstrating digital systems and the business models around them. Her experience includes a PhD in the application of simulation and informatics solutions to support quality improvement in manufacturing and 12 years' experience delivering industrial projects that generate business benefits on the back of digital technologies. We asked Dr. Huertas about the national landscape for digitalisation in the UK and how she describes the level of innovation and development in the UK.

Starting with the landscape of digitalisation in the UK. What is the current status?

In January this year, the Government published their industrial strategy for the UK, covering everything from skills to new business models to different sector deals. This includes ten areas of focus in terms of industrial strategies for companies.

Sector deals are a key focus here. The Government wants us to build on our strengths. The UK has world class aerospace, automotive and digital sectors. A review of industrial digitalisation in the UK was announced and Juergen Maier, CEO of Siemens UK was asked to lead this review. We've been working on this since January and results will be reported to the Government later in the year.

As part of this industrial digitalisation review we have several verticals representing the key sectors and horizontals which report recommendations to the Government in the areas of international benchmarking, skills/talent, adoption, barriers and jobs. The latter is especially important because we need to be aware of the impact digitalisation will have on jobs in the UK and we take the right

actions to make sure the result is positive.

In parallel we have an industrial group called Digital4Industry (D4I). Formed just over two years ago, the task is to combine all the pieces of the puzzle in the UK. We have a lot of initiatives and D4I aims to bring everyone together and exploit synergies and future opportunities. Hence, we are connecting industry with academia, governmental and non-governmental organisations. We have around 40 organisations in the room, around 60% of them represent industry. Here, we've set up six working groups: business transformation, innovation, research, standards, skills & societal impact and cyber security & legal frameworks.

On a very practical level, what kind of support do you expect for SMEs when it comes to adapting technology in general?

SMEs require support through the whole journey, all the way to the point where they are extracting value from new technologies sustainably. The initial stage is very much about raising awareness amongst SMEs to reach the understanding that this is not just hype, it's about business benefits and creating additional value in

the company. The next step is explaining what the journey means for them specifically; how these new technologies can add value and actually contribute to their business model. Afterwards, they need support looking for the right partners, build a business case and get appropriate funding to bring their ideas to life. During the innovation process, de-risking technical solutions is key to avoid business disruption and loss of investment. During the whole innovation process, SMEs need to be aware of business change management process and the necessary skills to achieve successful and sustainable adoption of new technologies. Even if you're able to adopt the technology, it's not going to work if employees don't have the skills to run it. People, process and technology, in that order, are they key pillars to this process.

In terms of methods, are you looking for opportunities through collaborations or is it more about competition? What kind of impact could BREXIT have here?

The level of innovation and development in the UK, how do you see it in comparison to the rest of the world?

In terms of innovation and development a lot of the work we do is in collaboration with Europe. Aside from the more obvious topics (FoF, ICT, H2020), we've also collaborated in policy making through support actions and working groups, particularly around digital platforms and digital innovation hubs.

We continue to work with European and international partners today and that is not going



During the innovation process, de-risking technical solutions is key to avoid business disruption and loss of investment.

to stop. International collaboration is key in the dynamic socio-economic landscape we live in today and there are trade links we can't ignore.

In terms of the state of UK's innovation and development, I would say we are very much leading the pace in areas of strength. We have a lot of activities and initiatives in place and we keep working hard to make sure that are connected and coordinated in line with industrial needs. At the conference, I will be talking about examples of areas where UK is clearly leading.

EIT Innovation Community on Added Value Manufacturing

Mathea Fammels, Head of Policy and Communications Unit, the European Institute of Innovation & Technology (EIT)

The EIT, Europe's largest Innovation Community, powers Europe's top innovators to turn their best ideas into products, services and jobs. We asked Mathea Fammels how that is done and how different stakeholders can benefit from KIC.

Can you give us a quick course on the EIT and its main goals?

We bring business, higher education and research together to jointly deliver world-class solutions to societal challenges. We have more than 1,000 partners across Europe, more than 1,200 entrepreneurs have graduated with EIT-labelled degrees, and many more are about to join them. These change-makers have gained the practical insights they needed to effectively turn their ideas into action, and to demonstrate this, the EIT Community has created more than 300 innovative start-ups. EIT-supported scale-ups and ventures raise millions of Euros in investment and are among Europe's innovation leaders.

We are currently working towards three strategic objectives: growing our existing innovation communities, setting up new ones and, finally, reaching out to the wider innovation community in Europe (and beyond) to make the results from our activities available. This means working together with business communities, research organisations and universities to provide novel solutions in the area of added value manufacturing. We are not talking about just another research project, it's a long-term commitment lasting 7-15 years. I will share all the details for interested applicants during my

presentation.

Can you elaborate a little bit regarding the call for knowledge and innovation communities (KIC)? It's clearly a very important part of EIT's activities.

The competition for a new Innovation Community in the area of added value manufacturing is a call for interested parties to form a partnership with other organisations (small or large enterprises, research organisations, universities) to develop a strategy for addressing key societal challenges in this area. It sounds broad, which is deliberate, because we at EIT believe in the bottom-up approach: stakeholders know best. The goal is to speed up the process of bringing new innovations to the market while enhancing innovation capacity, creating new jobs and growth.

What are some of the takeaways from the last KIC Call?

Innovation is a constant learning process and there are numerous things to be learned. During our latest competition for new Innovation Communities published in 2016, we were able to select a new Innovation Community in the area of food, but not in the area of added value

manufacturing. We felt that the submitted proposal neither reached the required level of excellence nor was there a convincing enough strategy to deliver solutions to the market. However, we didn't stop there. Instead, we followed this up by conducting a comprehensive 'lessons learned' exercise where we analysed why certain things were not addressed the way we had expected. We also interviewed partners who had been involved in the consortium and drew conclusions which have been translated into three key documents: the new Call text, the new selection criteria and the new framework of guidance (a manual for applicants).

How can different stakeholders benefit from KIC? What's in it for each party?

There is something for everyone: businesses can become part of the movement that creates tomorrow's entrepreneurs. They can take advantage of opportunities to access exceptional talent, innovation know-how and new markets.

For entrepreneurs, they are able to start a new venture, improve their competitiveness, find commercial success and obtain support and finance.

Public Authorities can leverage Europe's investment in innovation and shape Europe's towards a more sustainable and inclusive future.

Researchers can use these partnerships to get their ideas off the ground and bring great innovations to life. They can also access support and finance.

Students can unleash their innovation potential by combining technical studies with entrepreneurial ones in unique programmes, and



The goal is to speed up the process of bringing new innovations to the market while enhancing innovation capacity and creating new jobs and growth.

have a real opportunity to take their best ideas to the market.

Universities become part of a movement that enables innovation to flourish. They help create a favourable environment for cross-sector and cross border interaction.

For everyone - the competition for a new Innovation Community in the area of added value manufacturing, is a chance to join us, benefit from being part of our unique pan-European network and make innovation happen!

Metrology: a Key Enabler for National Industry 4.0



Paula Knee, Head of Analysis and Evaluation, National Physical Laboratory

Paula's career has spanned industrial & public sector R&D and science & innovation policy consulting. After a physics degree, she started her career in applied R&D in a Silicon Valley start-up and then at NPL, before moving into science and innovation policy consulting. She has delivered innovation consultancy projects for key UK and international public institutions such as the UK's Department for Business, Energy and Industrial Strategy, the European Commission and European Space Agency and has worked directly with technology start-ups as a business adviser and investment broker.

At the National Physical Laboratory she is responsible to demonstrating the impact of NPL's measurement science. Until recently she was the Impact Manager for EURAMET responsible for capturing and assessing the impact of two large-scale pan-European metrology research programmes. She firmly believes that metrology is a use-focused technology that delivers significant impact to the economy and society

- The role of metrology in manufacturing
- The economic impact of metrology
- The role of metrology in Industry 4.0

IPC Smart Factory Standards

David W. Bergman, Vice President Standards & Training, IPC - Association Connecting Electronics Industries

David W. Bergman has worked at IPC for more than 37 years of which more than 30 have seen him leading the staff team responsible for IPC standardization efforts, education and certification programs. David is also responsible for joint activities with related sister organizations and was selected to serve for 10 years as Secretary General of the World Electronic Circuit Council. In recognition of his efforts to identify alternatives to CFCs for defluxing Printed Wiring Board Assemblies, David was awarded the U.S. EPA's Stratospheric Ozone Protection Award as well as EPA's "Best of the Best" Stratospheric Ozone Protection Award. He is also a recipient of Solderterc Global's Lead Free Solder Award. David has degrees in Biology and Chemistry from the University of Illinois Chicago. We asked Mr Bergman about IPC's view of global standardization and its future plans.

What is IPC's take on global standardisation?

IPC is an industry association that supports the manufacture of electronics globally. Currently we have over 4300 member locations worldwide. One of IPC's most important services is the development of standards for industry. Currently we have over 4000 industry experts from 46 countries that are participating in IPC's standardization process. While historically many IPC standards were originated in the United States, we now have multiple standards that have originated in Europe and China. In Europe our members are focusing on support for Automotive electronics. We have hosted standards meetings in India and Korea as well. IPC is working hard to help companies everywhere to get involved in IPC's global standards development process.

How IPC is supporting its members in the transition to Industry 4.0?

Our current efforts are related to data communication on the factory floor. The IPC

committees have commitments from the majority of the market leaders in equipment used in electronics assembly to create a communication standards that will help serve the smart factory vision of Industry 4.0. This standard is called IPC Connected Factory Exchange (IPC CFX standard) The mission of the committee is as follows:

- Create a single, common standard for data exchange (plug & play)
- Enable modern, smart, digital, computerized Industry 4.0 solutions
- Eliminate waste & enable value creation throughout the industry
- Be accessible to companies in all sizes and sectors

The committee established the following mandate for the data format to support:

- "Plug and play" IoT communication standard

- Bi-directional exchange of information
- Connect every process, automated, semi-automated & manual
- Inclusive of bespoke processes, such as functional test
- Adaptable for new automation and robotics

Could you please tell us more about industry due diligence in selecting format?

The committee spent nearly 1 year evaluating the options for the IPC CFX standard. A comprehensive technical Comparison of the Following Protocols was developed and reviewed:

- MQTT (Message Queue Telemetry Transport)
- XMPP (Extensible Messaging and Presence Protocol)
- AMQP 1.0 (Advanced Message Queuing Protocol)
- GEM/SECS HSMS (High Speed SECS Message Services)
- REST (Representational State Transfer)

A comprehensive list of pros and cons were documented for each protocol and presentations were made to the committee. Following this a vote was taken for the format and it was concluded that AMQP 1.0 was the protocol supported by most companies. So IPC CFX will be developed using AMQP 1.0. The goal of the committee is to create a solid transfer protocol foundation that will form the basis of the smart factory communication. It is fully anticipated that equipment companies will build on top of the IPC CFX protocol to provide high value functionality that is key to success in the Industry 4.0 vision.



IPC is working hard to help companies everywhere to get involved in IPC's global standards development process.

What is the current status and future plans?

Progress is being made very quickly. The decision on format was made in February this year. A very well drafted proposal was prepared and reviewed by the committee in September. A CFX developers tool kit has been developed and will hopefully be released as an open source tool for industry use in Q4 2017 . We are also anticipating some demonstrations of CFX in action at productronica this November with further test trials taking place with planned reporting at IPC Apex in February 2018. With this timeline the goal is to have the standard out for official industry voting by Q2 2018.

EuroVR Initiative and VR&AR Opportunities in Personalised Product/Services/Manufacturing

Marco Sacco, Head of Division, Institute of Industrial Technologies and Automation, National Research Council of Italy / President, EuroVR

Mr. Marco Sacco is responsible for the three Virtual Labs of ITIA-CNR (Milan, Lecco and Bari) created to transfer the AR/VR technologies to the Italian industries through active collaboration on research and industrial projects. We asked him what is currently going in the area of VR&AR, what the opportunities were as far as Europe is concerned and what might be the opportunities for product and process customization.

What is currently going on the area of VR&AR and what are the opportunities as far as Europe is concerned?

Nowadays, there are many devices available on the market which have really ignited the conversation around AR&VR. Big players like Microsoft, Apple, Samsung and Google have invested a lot of money into these technologies, allowing people to purchase AR&VR devices for a relatively low price. Just five years ago, if you wanted to set up a VR installation you would have invested several hundred-thousand euros. Now the same can be done for a mere thousand. Due to the low prices, more users and companies have adopted this technology.

Looking at Europe, we have a very solid basis because our research started in the 90s. Hence, we have a lot experience when it comes to application development. Unfortunately, most of the devices we use are in the hands of US and Asian companies.

Thinking about Manufature and the manufacturing sector then this is most definitely one of the areas where companies could really benefit from AR&VR. But there is also huge potential for the medical sector, cultural heritage

and gaming for example. All in all, we are currently unable to fill the gap in terms of devices, but we can play a great role in development and research.

What could be the opportunities for product and process customisation?

Back in 2005, we were working on an AR system for product customisation. Back then we were mainly talking about footwear manufacturing. We developed a tool which supported customisation from the user's point-of-view. VR&AR could be used as a support tool for the end customer to see what the product will actually look like after the customisation and hopefully encourage purchasing. VR&AR could be also used much earlier in the product lifecycle. Designers for instance can check how different customisation aspects affect the final product.

Then, if we talk about customised factories, we have tools available for this as well. We have done several samples of VR&AR environments for designing and deploying factories in different sectors. Of course, it becomes much more complex when we are dealing with a single product because we need to integrate additional digital tools and information.

I'm speaking solely based on our experience but there are several researchers around Europe who have knowledge in other possible application areas.

Can you talk us through your upcoming flagship project you are planning to launch as part of the next framework program?

The idea is to launch a AR&VR flagship project as part of European Commission's Next Generation Internet initiative. We are planning to present a coordinated action under ICT-30 during the coming call for proposals. It's currently still a draft but the goal is to aggregate the whole EU community and define a roadmap identifying the main research line for interactive technologies (AR/VR). EuroVR has created a connection between several national AR&VR associations, companies, universities and research centres. We are in the process of building this community in order prepare the proposal.

I'm hoping my presentation at Manufuture will attract more interest not only amongst academia but also amongst the end users. We are finally starting to see concrete opportunities for AR&VR application in manufacturing as opposed to the prototype/demo basis solutions we've seen previously.



The manufacturing sector is most definitely one of the areas where companies could really benefit from AR&VR

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INDUSTRY 4.0 Giving New Opportunities for Innovative Cooperation



Dr. Géza Haidegger, Senior CIM research engineer at MTA SZTAKI / ManuFuture-HU Board-member

Mr Géza Haidegger graduated the Technical University of Budapest in 1978 and begun to work at the Hungarian Academy of Sciences, (CAI) Computer and Automation Institute, Mechanical Engineering Automation Department. He obtained his second MS diploma on Metrology Technics in 1982 and received his Ph.D. in 2002, on Open Systems in Factory Automation. He has been in charge of the design of industrial control systems, CIM (computer integrated manufacturing) such as CNC, distributed PLC systems, robot controllers, industrial cell-controllers. He studied production management in Japan, and obtained the title of Eur Ing. EURO-engineer by FEANI. His attention was directed towards standardized communication methods, and focused on MAP (standards based industrial) computer networking. He has initiated the East-European MAP/TOP Interest Group, has been elected as Steering Committee member of EMUG and EEMIG, (User's groups for MAP) and has directed the operation of the MAP Training Center at CAI (presently renamed to Institute for Computer Science and Control). Member in Scientific Societies, (IFIP, IFAC, GTE, BATCH-AUTOMATION-FORUM, Robotics) author and co-author in numerous publications (over 150++). Main field of interest: communications in CIM systems, networking with real-time needs and multimedia in industrial architectures. Car recycling, production technologies for micro- and nano-products, robotics are the recently related R&D topics. Since the early appearance of embedded industrial control systems intensively got involved in Cyber-Physical productions systems. Nowadays, these topics are covered by the INDUSTRY4.0 international and national platform-development activities.

Géza has participated in the ManuFuture European Technology Platform throughout the last decade. He is lecturer at the Institute of Technology and Economics Budapest, on topics like Factories-of-the-Future, modeling factories and innovation management. He has lead several Hungarian and joint European projects, presently managing a German-Hungarian EUREKA-based Industry4.0 development. From August 2017 he is the Honorary Professor at AMITY University, India.

- Progress from the 3rd Industrial Revolution
- Company-level activities from SME-s to multinational companies
- Interregional level in Hungary
- National level – ManuFuture-HU, IPAR4.0 NTP,...
- EU-regional, Smart Specialization
- HORIZON 2020, Teaming, ManuFuture-EU, EUREKA,...
- Global level – innovative cooperation
- Personal experiences

Poland on the Way to Industry 4.0. Existing Preconditions and Measures Undertaken

Andrzej Soldaty, Founder, The Initiative for Polish Industry 4.0

Andrzej Soldaty has major experience in the field of industrial automation. In 2017 he was invited by the Polish Ministry of Economic Development to lead a government project which is about to create body supporting the transformation of Polish industry to the Industry 4.0 standard. We asked Mr Soldaty about how Poland is building its own vision of Industry 4.0 for the manufacturing sector.

Poland is building its own vision of Industry 4.0 for the manufacturing sector. Can you talk us through this vision?

Poland is approaching Industry 4.0 from an organisational side. Technological pillars like data and autonomous machines/equipment are typically developed in other countries. But at the base of this we need to look into Poland's manufacturing in terms of changes within the organisation: digital integration in value chains, the changing position of workers, etc. Germany has defined a dual strategy for Industry 4.0: support for the suppliers of equipment/machinery and for the development of the German market as a whole. We have a similar approach in Poland, nevertheless, it is important to bear in mind that preconditions for the transformation differ significantly. Not only do we need to support the existing domestic suppliers, but most of all we need to create appropriate conditions for the development of the 4.0 solutions. What I mean is apart from building infrastructure and introducing regulation we have to design incentives that will boost mutual trust and cooperation. We're looking for innovations that are relevant to softer side of Industry 4.0 solutions from which our market could truly benefit (software, AI).

Poland is one of the biggest and wealthiest countries in Europe. What are the preconditions for this transformation in Poland?

We have divided our preconditions into four perspectives: market, environment, technology and people. Each should be analysed in more detail. So, if we look at the market there are numerous domestic suppliers of fragmentary digital solutions that need to be integrated to achieve the Industry 4.0 level. On the other hand the existing Polish suppliers export most of their products as the internal market is underdeveloped. On the environment's side it's about regulations, mechanisms for support and standardisation. Technology comes with questions around automation and robots currently used in Polish manufacturing. And finally concerning people, we should consider the level of knowledge and competency needed for Industry 4.0 (the amount of preparation we need to do) and also the current culture in terms entrepreneurship and innovation. The share of science and maths graduates Poland is above the EU average. These numbers, however, are not reflected in terms of our economic achievements. We need therefore to act, so as not to waste this potential.

Can you talk us through some of the most important initiatives that are now ongoing within the Polish manufacturing sector?

Here we have two streams: bottom-up and top down. There are more and more emerging bottom-up initiatives which however are dispersed. These initiatives come from people who are acquainted with Industry 4.0 (manufacturers, academia, etc.) and have experience in this field. They make up a bottom-up movement oriented towards implementation and development of Industry 4.0 in the Polish manufacturing sector. One of these movements has been merged with the governmental initiative established by Poland's deputy Prime Minister Mateusz Morawiecki in order to design a national transformation strategy.

The two streams are currently working together on a project aimed at launching a new organisation – the Future Industry Platform. The team was set up by the Ministry of Economic Development and includes experts from industry who are responsible for developing the concept of transformation.

Is there already something you can share in regards to this transformation concept?

At the moment, it is under preparation. The general concept is based on the platform's model. It's not like the typical pipeline. It means integration



Not only do we need to support the existing domestic suppliers, but most of all we need to create the right conditions for the development of 4.0 solutions.

of two groups (say technology suppliers and users) by creating value and for each value we have a specific set of activities. Hopefully, by the time of the conference I will be able to present a concept that is approved by our sponsor.

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European and National (Finnish) Experience in R&D Collaboration in Manufacturing

Tomas Hedenborg, President, Orgalime

Tomas Hedenborg is Group CEO of Fastems, a leading independent manufacturer of factory automation systems with a strong emphasis on software. He is currently also the President of Orgalime, the European Engineering Industries Association. Mr. Hedenborg previously held the position of President and CEO of both Finn-Power Oy (machine tools) and HBPO (front end modules for the automotive industry). He has a strong background in mechanical engineering, specifically in the automotive and machine tool sector. Having spent half of his professional life in management positions in the R&D area, the last 15 years he has managed companies with high development potential, through times of radical strategic renewal. Mr. Hedenborg holds numerous positions of trust, incl. Board member of the Federation of Finnish Technology Industries, Chairman of the Board of DIMECC Ltd. and Chairman of the Finnish Industrial Internet Forum FIIF. We asked Mr Hedenborg how the EU can add value for companies in the context of collaborative industrial research.

How can the EU add value for companies in the context of collaborative industrial research?

The EU Framework Programmes play an important role in encouraging cross-border cooperation between companies of different sizes and research and technology organisations (RTOs) or universities, creating pan-European networks and opening new market opportunities. Collaborative industrial research gives incentives to create synergies throughout Europe - these organisations would not necessarily have these opportunities if there were no European funds available.

EU research projects help companies develop cross-cultural skills that will prove useful when their product or service is marketed in Europe. It forces organisations to step out of their comfort zone and thus become more innovative.

Besides, industry appreciates the joint risk-

sharing with the European Commission and the long-term vision of PPPs. Collaborative industrial research at EU level enables co-creation of value for organisations in the projects, and in the long run for the entire European economy as well. Companies can make bolder investment decisions based on the research project results.

What are the benefits and drawbacks of the Finnish PPP experience?

PPPs are an effective tool. The collaboration between industry, universities and RTOs is very much valued by the three types of organisations. PPPs generate relevant solutions tailored to and with industry. It is a win-win situation, not only for industry but also for academia, since it is proven that the most cited scientific publications come from projects where industry personnel take part in the work.

According to leading OECD and Finnish economists, Finland risks losing the most important innovation advantage that it has been building for the last 20 years both in terms of quality and volume: the industry-academia collaboration.

This is due to the fact that the Finnish government significantly decreased public funding after 2014. The impact was very quickly felt both on R&D private investment in Finland and on employment levels in our industry.

Therefore, we call on the European Institutions not to duplicate this experience at EU level and to continue funding contractual PPPs such as the Factories of the Future PPP. Public R&D support and funding is important to industry, and not only to academics or start-ups.

What will the next framework program FP9 bring along for manufacturing?

Framework Programmes are a key asset of the European Union that should be kept and even further developed after 2020. Orgalime supports a forward-looking, ambitious and workable EU-wide framework programme for research and innovation.

However, it seems that in the current debate over FP9 the pillar structure might change in a way that makes the importance of manufacturing decline. The Engineering Industry would not welcome a change to the current industrial pillar, which exists today in Horizon 2020 and which supports PPP such as the Factories of the Future PPP.



Collaborative industrial research at EU level enables co-creation of value for organisations in projects, and in the long run for the entire European economy as well.



Furthermore, we hope that test and demonstration facilities will be more supported in FP9. They are crucial for the manufacturing ecosystems to test ideas and inventions in order to identify potential innovations.

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Future of Manufacturing – China and USA Perspective

Dr. Jun Ni, Shien-Ming (Sam) Wu Collegiate Professor of Manufacturing Science and Professor of Mechanical Engineering, University of Michigan

Dr. Jun Ni has served as the founding Dean of the University of Michigan – Shanghai Jiao Tong University Joint Institute located in Shanghai, China since 2006. He is also the director of the Wu Manufacturing Research Center and the co-director of a National Science Foundation sponsored Industry/University Cooperative Research Center for Intelligent Maintenance Systems at the University of Michigan. He has served as a Vice Chairman of Global Agenda Council on Advanced Manufacturing at the World Economic Forum since 2010 and is very active in various national and international studies of policy recommendations for advancing manufacturing competitiveness globally. We asked Dr. Jun Ni to share some insights about strategies for the future of manufacturing in both China and USA.

Could you please share some insights about strategies for the future of manufacturing in both China and USA?

In both China and USA, future growth in manufacturing sectors has been given extremely high priority by governments and industrial leaders. After the re-election campaign of President Barack Obama in 2012, US government launched Advanced Manufacturing Partnership (AMP) (later upgraded to AMP-2.0) and established a series of national initiatives including the establishment of an inter-agency government office to coordinate all manufacturing related research programs funded by various federal agencies, the creation of more than a dozen national networks of manufacturing innovations, the provision of incentives for re-shoring manufacturing operations back to US, and the funding to fill the gap between fundamental research and commercialization. Although President Donald Trump rejected almost all of Obama's initiatives, promoting manufacturing is one of the few initiatives that remain a priority for

the federal government.

In 2015, Chinese government unveiled a grand national strategy, called Made-in-China 2025, which has three stages. Each of the three stages will require a decade to complete. This first stage (i.e., Made-in-China 2025) will focus on greatly enhancing the competitiveness of Chinese manufacturing enterprises by improving manufacturing quality, while the second and third stages are designed to increase the innovation capability of Chinese enterprises for entering the first tier of the world's manufacturing countries, and to elevate Chinese firms to the leading group in the world in the third decade, respectively.

What are the highlights of the World Economic Forum Global Future Council (WEF/GFC) on the Future of Production?

Since 2010, the World Economic Forum (WEF) has started to focus on the impact of manufacturing sectors on many global issues, such as inclusive growth, sustainability and employment,

innovation, workforce development, energy and natural resource consumption, international trade and logistics, etc. WEF launched several initiatives related to manufacturing, Global Agenda Council on Advanced Manufacturing, Task Force on the Future of Manufacturing, and Global Future Council (GFC) on the Future of Production. WEF has assembled a group of policy makers, economist, technology, educators, industrial executives, and civil society activists to apply a multi-stakeholder approach to establish a common vision for the future of production. Currently, stakeholders in global production do not speak the same language and view the system from very different perspective. The WEF/GFC team are working to address major concerns about innovation and the speed of technology adoption, the impact of technology on people (citizens, consumers, job-holders), how to build the right partnerships with the right stakeholders, how to embrace sustainability as a key competitiveness advantage, and what are the key drivers for the future of production development.

What are the key factors and drivers affecting the future development of global manufacturing industries?

Key factors and drivers affecting the future development of global manufacturing industries include, but are not limited to, the following:

- Government policies (e.g., R&D incentives, import/export taxes, environmental regulations, etc.)
- Innovation ecosystem (e.g., R&D investment, IP protection, etc.)
- Technology advancement (e.g., robotics, digital technologies, automation, IoT, etc.)



“WEF has assembled a group of policy makers, economists, technology, educators, industrial executives, and civil society activist to apply a multi-stakeholder approach to establish a common vision for the future of production.”



- Trade agreement (e.g., multilateral, regional, global, etc.)
- Foreign direct investment
- Infrastructure and energy supply
- Reliable access to material resources
- Workforce and talent development
- Currency exchange
- Wage growth
- Emergence of new consumer markets
- Global logistic costs

Rapporteurs' Reports from the Different Programme Streams



Prof. Reijo Tuokko, International Cooperation Manager, DIMECC Oy

Prof. Reijo Tuokko has 40 years' industrial and academic experience in discrete manufacturing, robotics and manufacturing automation. After retirement in 2014 from 26 years' full professorship at Tampere University of Technology he has worked at DIMECC Ltd. as a manager on international cooperation. He is member of MANUFUTURE High Level Group (HLG) and Implementation Support Group (ISG), and has been Board member of EFFRA in 2009-2013. Prof. Tuokko is author of over 300 technical and scientific publications in magazines, journals and conference proceedings, and has organized and chaired numerous international manufacturing related seminars, conferences and summits.

Ensuring Competitiveness through Digitalisation

Urve Palo, Minister of Entrepreneurship and Information Technology of the Republic of Estonia

Organising Manufuture 2017 in Estonia is a clear sign that manufacturing is not only a matter for large industrialised countries but has a Europe-wide importance, including for small states. At the European Union level, more attention has been given to creating a new industrial strategy in order to boost the economic growth of the EU area. As it turns out, many Member States have already established their own national platforms to increase the international competitiveness of the manufacturing sector. Estonia is going to join them by creating its industrial platform in autumn 2017.

Over the last decades, technologies, and information technology in particular, have undergone significant changes, moving us into a digital world. These technological developments have had broad-ranging implications for the economy and society, meaning that many aspects of our everyday life have been turned upside-down – the ways we communicate, purchase goods, use public services etc. are constantly changing and that requires adaptation from all of us. Aside from the individual and government level, the manufacturing industry needs to keep up with IT developments as well. We have to ensure that the opportunities to digitalise in the manufacturing are well seized for introducing product and process innovations. This way it is possible to move up to higher value-added activities in global value chains and enter the market with more competitive products.

The use of big data and smart solutions in production processes and for running companies is one of the key features in future manufacturing. Digitalisation solutions, e.g. within lean manufacturing, provide companies

with opportunities to use resources in a more efficient way. It does not only concern the sustainable and optimised use of raw materials and energy but also labour, and thereby improves oversight over costs in the entire supply chain. Digitalisation also helps manufacturers offer custom-made solutions, which introduces more flexibility, and adopt new business models that enable enterprises to create and capture more value.

Accordingly, it is natural that discussions on big data and data protection issues have become a daily topic in public debates, as the secure use of data is the foundation for enhanced cooperation, improved integration of vertical and horizontal value chains and therefore, increased competitiveness of the whole value chains. In this light, we have to ensure that our regulatory framework supports the free movement and sharing of data across borders within the EU. Here, digital standards, intellectual property, cyber security issues and personal as well as non-personal data regulations, are of such a broad scope that single Member States cannot

efficiently address them alone and hence, action needs to be taken at the EU level.

Even though some would argue that digitalisation and automation pose a threat to our future manufacturing jobs, it encompasses a part of a creative destruction process that paves a way for more productive jobs and thereby higher wages for industrial workers. It is inevitable that jobs are changing and some will even disappear, but at the same time many new ones will be created. Routine activities will be partly or fully replaced by new technological solutions, leaving more time to focus on creative, highly paid activities. Data mining, analytics and security, robots and the like are fields that will create many new jobs in the future. In order to be prepared for that, it is imperative that educational and R&D structures are adjusted to new circumstances with a focus on re-learning as well as updating the profile of existing skills and competences - up-skilling and re-skilling will become more important in the future and engage members of various social strata.

On the way to higher welfare and productivity gains through the digitalisation agenda, improved flexibility and commitment is required both from private and public sector actors. It is important that we use our common strengths wisely at the



EU level in order to successfully adapt to the changing reality and become a frontrunner in the digitalisation process.

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Research and Innovation in European Manufacturing – Present and Future

Dr. Peter Dröll, Director for Industrial Technologies, Directorate-General Research and Innovation, European Commission

Peter Dröll is in charge of Industrial technologies in the European Commission's Research and Innovation Department. In this capacity, he oversees the optimal integration of Research and Innovation in the design and implementation of relevant EU policies that contribute to Europe's industrial and technological leadership. We asked Dr Dröll how would he describe the collaboration between European Commission's Research and Innovation division and industry.

How would you describe the collaboration between European Commission's Research and Innovation division and industry?

Starting on a more obvious note: Europe is very strong in terms of manufacturing (especially in high-tech manufacturing). Today 1 out of 5 jobs are in industry and within that, manufacturing is our strongest point. The future of our society is in very good hands if we have a strong industrial base. But how can we ensure this in an ever-changing world?

The answer lies in new technologies, production methods and facilities. By becoming more clean and intelligent, we become more competitive. The European Commission provides funding for cooperation across the EU to develop new technologies, notably in the manufacturing field. The common participants here are companies, technology and research organisations and academia. Companies representing industry are the strongest drivers here, but success really lies in all parties working proactively together.

Factories of the Future (FoF) is another interesting initiative. What is the main idea and what are the hottest topics in regards to FoF?

Firstly, it's a great example of public-private partnership. We have a long-term commitment both from our side and that of industry to look into the future of manufacturing. It all started with dialogue where industry was asked to come up with a long-term research and innovation agenda identifying the main gaps and challenges we want to address. We have also agreed on key performance indicators, on which industry has to deliver. They include the development of new, cleaner technologies and also new skills. We therefore support research innovation projects in these areas.

Today the key trends are digitalisation and energy efficiency. Big investments are in-store for these two. It's very exciting and really lets your fantasy fly: digital twins, zero defect production, super flexible and digital plants...

What's your preferred collaboration level: SME or large enterprise?

We are open to both. The average project size is about 8-9 million euros for the duration of four years. You'll find big companies as much as smaller ones in the mix. SMEs have proven to benefit a lot from our projects. After becoming partners,

they complete specific tasks and are able to contribute into the overall project. SMEs are very active in industrial technologies. In addition, we have a specific SME instrument, which supports SMEs which do not want to cooperate in a big project. It consists of two stages: 50 000 euros for a business plan and up to 2 million euros to bring their ideas to the market.

Can you name a practical example, something that has revolutionised manufacturing and that people can relate to?

Automation immediately pops into mind. As part of a very successful project, automation robots were brought onto the factory floor level in a way that no longer separates them from other workers. We're talking the same industrial robots you see at trade fairs. They are very powerful and very dangerous. Hence, during production they have been strictly separated for safety reasons.

Our project introduces new sensors and intelligence to the robots, which allows them to interact with humans and support them. The robot will act as a partner and for instance lift heavy weights for you. We have several application fields for this new technology across several businesses. Consequently, it proves that humans will maintain certain tasks and industry manufacturing in Europe has a bright future.

Entering the second half of Horizon 2020, what are the prospects for the future?

Horizon 2020 is truly the hottest topic if we talk about research innovation in Europe at the given moment. An interim evaluation of all our programmes has pointed to many achievements gained through our investments. All experts and stakeholders agree:



An interim evaluation of all our programmes has pointed to many achievements gained through our investments.

we need more of them. Acknowledgement of the importance of investments in research and innovation is the first big step when preparing for a new European-level programme.

The question we are all asking: what will be the role of manufacturing and industry in this future programme? Here, we need to be clear about the strategic importance of our capacities in Europe relating to key enabling technologies (also from a geopolitical point of view); having all the main elements in a value chain available in Europe. That will be one of the key questions for the forthcoming programme

Closing of the Presidency Event Manufuture 2017



Jüri Ratas, Prime Minister of Estonia

Mr. Ratas has finished Nõmme Secondary School in Tallinn, graduated from Tallinn University of Technology in the area of Business Management and obtained his Master's degree in Economic Sciences from the University of Technology. He also holds a Bachelor's degree in Law from the School of Law at the University of Tartu. His service in Tallinn administration started in 2002 when he was elected the Economic Adviser to the Tallinn City Office (2002-2003). During 2003-2004 and in 2005 Jüri Ratas served as the Deputy Mayor of Tallinn and from 2005 to 2007 as the Mayor of Tallinn. He has been elected to Tallinn City Council in 2005, 2009 and 2013. In 2007-2016 Jüri Ratas held the position of the Vice-President of the 11th, 12th and 13th Estonian Parliament.

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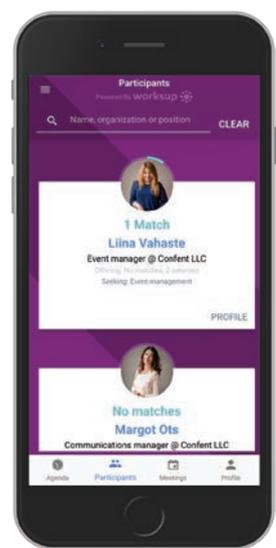
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