Deliverable D2.4

Second Expert Group Meeting Report

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ICT Policy, Research and Innovation for a Smart Society

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D2.4: Second Expert Group Meeting Report

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[1] The 2nd meetings of the PICASSO Expert Groups took place on June 19/20, 2017, in Minneapolis, US (later than initially planned), with follow-up discussions on the EG action plans. This report is delayed accordingly.

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Abstract:

This report provides a summary of the 2nd meetings of the PICASSO Expert Groups that took place in conjunction with the public *Trans-Atlantic Symposium on ICT Technology and Policy* that was organized by the PICASSO project in Minneapolis, USA, on June 19/20, 2017. For each of the four EG meetings, the meeting objectives, agenda, participants, and outcomes are described. In addition, the action plans of the Expert Groups for the remainder of the project that were discussed in Minneapolis and finalized after the meetings are briefly summarized.

Keywords:

PICASSO Expert Groups, 5G, Big Data, IoT, CPS, Policy, EG meeting

Disclaimer

Executive Summary

The four PICASSO Expert Groups (EGs) came together for the second time at the public *Trans-Atlantic Symposium on ICT Technology and Policy*[2] that was organized by the PICASSO project in Minneapolis, USA, on June 19/20, 2017. The meetings in Minneapolis took 2 - 2.5 hours each and were attended by 38 EU and US experts overall.

The meetings of the technology Expert Groups had the main objectives to discuss, validate, and refine the contents of the PICASSO opportunity report, the most promising key technology themes and RDI topics, and concrete proposals for EU-US collaboration actions. The main meeting objectives of the Policy Expert Group were to review the policy landscape in which EU US ICT R&I collaboration takes place, review the current state and discuss the next steps towards developing the Policy White paper. In all meetings, the EG action plans for the remainder of the PICASSO project were discussed.

All meetings achieved their objectives and led to focused, fruitful discussions between all participants. In addition to EG-specific action items, all technology Expert Groups plan to organize public meetings in conjunction with the 3rd EG meetings in the first half of 2018. In addition, they will investigate and propose potential strategic EU-US initiatives, will continue their community enhancement activities (including e.g. organization/contribution of/to webinars, support of the CROSSROADS tool, development of success stories, dissemination), and will revise the opportunity report based on results of the EG activities at the end of the project. Over the next year, the policy EG plans to finalize the draft policy paper on standardisation and organize a related webinar, develop the fourth and fifth policy paper (on Industry 4.0 and on a topic that is still to be identified), and based on these efforts develop the final Policy White Paper for presentation at the PICASSO final event.

[2] http://www.picasso-project.eu/2017/06/27/looking-back-on-picasso-trans-atlantic-symposium-on-ict-technology-and-policy/

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The PICASSO Project

The aim of the 30-months PICASSO project is (1) to reinforce EU-US collaboration in ICT research and innovation focusing on the pre-competitive research in key enabling technologies related to societal challenges - 5G Networks, Big Data, Internet of Things and Cyber Physical Systems, and (2) to support the EU-US ICT policy dialogue by contributions related to e.g. privacy, security, internet governance, interoperability, ethics.

PICASSO is oriented to industrial needs, provides a forum for ICT communities and involves 24 EU and US prominent specialists in the three technology-oriented ICT Expert Groups - 5G, Big Data, and IoT/CPS - and an ICT Policy Expert Group, working closely together to identify policy gaps in the technology domains and to take measures to stimulate the policy dialogue in these areas. A synergy between experts in ICT policies and in ICT technologies is a unique feature of PICASSO.

A number of analyses will be accomplished, as well as related publications, that will for a major part be made public and contribute to the project's outreach. Dedicated communication and dissemination material will be prepared that should support the operational work and widespread dissemination though different channels (website, social media, publications …). The outreach campaign will also include 30+ events, success stories, factsheets, info sessions, and webinars.

List of Acronyms

5G	Fifth generation
BD	Big Data
BDVA	Big Data Value Association
CPS	Cyber-physical System
EC	European Commission
EG	Expert Group
EU	European Union
FP9	Framework Programme 9
GDP	Gross Domestic Product
H2020	Horizon 2020
IA	Industry Association
ICT	Information and Communication Technology
IoT	Internet of Things
NESSI	Networked Software and Services Initiative
NIST	National Institute of Standards and Technology
NSF	National Science Foundation
OR	Opportunity Report
RDI	Research, Development, and Innovation
R&D	Research & Development
R&I	Research & Innovation
US	United States

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1. Introduction

The four PICASSO Expert Groups (EGs) came together for the second time at the public *Trans-Atlantic Symposium on ICT Technology and Policy*[3] (impressions are shown in Figure 1 and in Figure 2) that was organized by the PICASSO project in Minneapolis, USA, on June 19/20, 2017. The 1st meeting took place in Washington, D.C., in May 2016, see (1). The four Expert Group meetings in Minneapolis took 2 - 2.5 hours each and were attended by 38 EU and US experts overall, including several external experts that are not EG members.

In addition to EG-specific objectives, the main meeting objectives of the three technology-oriented EGs (Big Data, IoT/CPS, 5G) were to:

- Discuss, validate, and refine the contents of the opportunity report (2),
- Identify, discuss, validate, and refine the most promising key technology themes and RDI topics for EU-US collaboration,
- Identify, discuss, validate, and refine concrete proposals for EU-US collaboration actions,
- Discuss the EG action plans for the remainder of the PICASSO project.

The main result of the discussions between Big Data EG members and invited external participants (from the US Big Data hubs, BDVA, Big Data Europe, NIST, NSF) was that there is great potential for collaboration on specific Big Data sectors, where both US and EU have concrete needs which may be jointly tackled. The Big Data EG created three internal working groups between BDVA, NSF, PICASSO and US Big Data Hubs to work towards three topics: *Big Data Literacy*, *Smart Transportation*, and *Best Practices for Industry-Academia Partnerships on Big Data / Data Science*.

During their meeting, the IoT/CPS Expert Group discussed and refined the contents of the IoT/CPS opportunity report (in particular the analyses regarding application drivers, enabling technologies, comparisons of EU and US RDI priorities, and collaboration barriers). Out of the 6 technology themes for EU-US collaboration that are proposed in the IoT/CPS opportunity report, the topics with the highest priority were identified to be *trust, (cyber-)security, robustness, resilience,* and *dependability*, *humans in the loop*, and *model-based systems engineering*, and follow-up activities will focus on these topics. The three proposals for EU-US collaboration actions on IoT/CPS that are proposed in the opportunity report (regarding *roadmapping and benefit assessment*, the *facilitation of collaboration initiatives*, and *lightweight joint research and innovation*) were discussed in detail; refined proposals will be created based on this discussion for the next version of the report.

Figure 1: Impression from the public PICASSO symposium in Minneapolis (June 19, 2017).

The attendants of the 5G Expert Group meeting agreed that there is a strong synergy on technologies that have niche market shares. Five research topics were identified

[3] http://www.picasso-project.eu/2017/06/27/looking-back-on-picasso-trans-atlantic-symposium-on-ict-technology-and-policy/

focusing on a niche market strategy, some of which have been discussed in the opportunity report. A main result of the 5G EG discussions is the plan to submit a project proposal based on the identified topics by the 5G EG to a possible upcoming H2020 call in the spring of 2018 on EU-US 5G collaboration.

The main meeting objectives of the Policy Expert Group were to:

- Review the policy landscape in which EU US ICT R&I collaboration takes place,
- Review the current state and discuss the next steps towards developing the Policy White paper,
- Agree on an action plan for the remainder of the project.

The discussions within the EG focused on the analysis and validation of 3 policy papers that were developed by the EG so far, on the topics of *Data Protection and Privacy*, *ICT Security*, and *Standardisation*. In addition, a strategy for the development of the fourth and fifth policy paper and the final policy white paper that is due by the end of the project was developed. The fourth paper will most likely deal with *Industry 4.0*, not only considering the techno-economic aspects but also the regulatory policy context and the realization that the socio-economic context is not only about the impact on GDP but also about jobs. Potential subjects for the fifth paper are *Spectrum* (particularly relevant for 5G and IoT) or *Smart Communities* (where many things come together). The final topic will be chosen by the EG using internal discussions based on outlines written by EG members.

The remainder of this report provides more detailed summaries of the meeting objectives, agendas, participants, and outcomes of the four EG meetings. In addition, the action plans of the EGs for the remainder of the project, which were discussed in the EG meetings and finalized thereafter by the EG responsibles, are briefly summarized in the following sections. The action plans are described in more detail in the PICASSO report “Action plans of the expert groups” that will soon be made available for download on the PICASSO website at http://www.picasso-project.eu/outreach.

Figure 2: The PICASSO consortium at the end of the public PICASSO symposium.

2. Report of the Expert Group on Big Data

2.1. Meeting Objectives

The second Big Data Expert Group Meeting, which took place in Minneapolis on Monday, June 19, 2017, had the following concrete objectives:

- **Discuss** specific areas of **Big Data** and recent technological innovations related to Smart Transportation, Smart Cities and Smart Society in general.
- **Discuss**, **validate**, and **refine** the contents of the Opportunity Report.
- **Identify the most promising key technology themes** for EU-US collaboration.
- **Define and validate proposals for EU-US collaboration actions.**
- **Set up a solid communication and collaboration channel between the EU and US Big Data associations**.
- **Examine concrete collaboration actions and activities** between EU and US Big Data related organisations and associations
- Refine the **action plan** for the EG for the remainder of the project.

2.2. Meeting Agenda

16:00 – 16:15	**Opening and Round of Introductions**
16:15 – 16:50	**The Big Data Opportunity Report: Drivers, Needs, Opportunities, and Collaboration Proposals** • Overview of challenges, themes, opportunities, and proposals • Discussion, feedback, and prioritization of themes, opportunities, and proposals
16:50 – 17:50	**BDVA – BD Hubs: Opportunities for Collaboration** • Joint Event in EU • Other Opportunities
17:50 – 18:00	**Summary and Farewell**

2.3. Meeting Participants

The meeting was attended by both permanent and external members of the Expert Group. More specifically, 15 persons in total attended the meeting, of which 11 attended physically and 4 were connected via Go2Meeting.

2.3.1. Physical Attendance

Name	Organization Position
Nikos Sarris EG Chair	**ATC SA, Greece** Head of the ATC Innovation Lab, **member in the Steering Committee of the NESSI European Technology Platform** and a **representative of ATC in the General Assembly of the Big Data Value Association**
Sören Auer	**University of Bonn, Germany** Head of Enterprise Information Systems group, Member of the leadership council of Fraunhofer-Insitute for Intelligent Analysis and Information Systems (IAIS), **Coordinator of the Big Data Europe Initiative**
Andreas Metzger	**University of Duisburg-Essen, Germany** **BDVA – EU** Head of Adaptive Systems and Future Internet Applications, Chief technical architect of the European Future Internet Public Private Partnership project on transport, logistics and agri-food (FIspace), **Deputy general secretary of the Big Data Value Association** (BDVA) and steering committee **vice chair of the European Technology Platform NESSI**
Wo Chang	**NIST, USA** Digital Data Advisor for the NIST Information Technology Laboratory (ITL), Convener of the ISO/IEC JTC 1/WG9 Working Group on Big Data Co-chair of the NIST Big Data Public Working Group
Michail Bletsas	**MIT, USA** Director of Computing at the MIT Media Lab
Vasilis Papanikolaou EG manager	**ATC SA, Greece** Innovation Manager, ATC Innovation Lab
Chaitan Baru	**NSF, USA** Senior Data Science Adviser on CISE
Melissa Cragin	**Midwest Big Data Innovation Hub & University of Illinois at Urbana-Champaign, USA** Executive Director
Meredith M. Lee	**West Big Data Innovation Hub & UC Berkeley, USA** Executive Director
Lea Shanley	**South Big Data Innovation Hub & University of North Carolina at Chapel Hill, USA** Co-Executive Director
Stanley Ahalt	**South Big Data Innovation Hub & University of North Carolina at Chapel Hill, USA** Principal Investigator

	Director of the Renaissance Computing Institute (RENCI), professor of computer science at the University of North Carolina at Chapel Hill, and the head of the Biomedical Informatics Core for the North Carolina Translational and Clinical Sciences Institute (NC TraCS)

2.3.2. Remote Attendance (via Go2Meeting)

Name	Organization Position
Rene Baston	**Northeast Big Data Innovation Hub and Columbia University, USA** Executive Director
Arne Berre	**SINTEF, Norway** **BDVA – EU** Chief Scientist
Renata Rawlings-Gross	**South Big Data Innovation Hub & Georgia Institute of Technology, USA** Co-Executive Director
Andrew S. Hoffman	**University of Washington, USA** Data Ecologies Lab | Human Centered Design & Engineering Big Data Regional Innovation Hubs Investigator

2.4. Outcomes

This 2nd expert group meeting gave the opportunity for Expert Group members to interact with some of the most important actors and organizations from the Big Data sector both from the EU and the US. Key representatives from the BDVA, Big Data Europe, NIST, NSF, and all four US Big Data Innovation Hubs had the opportunity to interact and define some concrete areas and topics for collaboration between these organizations, to be exploited over the next period of the project.

The Expert Group (both Permanent and Invited External Members) agreed that there is great potential for collaboration on specific Big Data sectors, where both US and EU have concrete needs which may jointly tackled. Moreover, they have defined as a major obstacle for collaboration the fact that there is no joint funding opportunity available which will allow a more intensive and coordinated collaboration ecosystem to be formulated.

In conclusion, the meeting led to a fruitful discussion between all members that helped both sides to better understand the needs and opportunities that may lead to a concrete and stable collaboration relation between actors from both regions.

The main results from the meeting are:

- Validation of the Opportunity Report
- Validation of the Action Plan
- Definition of 3 working groups between BDVA, NSF, PICASSO and US BD Hubs, to work towards:
    1. Big Data Literacy
    2. Smart Transportation

3. Best Practices for Industry-Academia Partnerships on Big Data / Data Science

2.5. Action Plan Summary

More details are given in deliverable D2.3.

Activity	Activity Description	Time Frame	Success Criteria
Opportunity report update	**Update the Opportunity Report** by the incorporation of additional content from publicly available documents and the engagement of external organizations/association	Feb. 2018 - June 2018	Updated opportunity report for Big Data
Webinars	**Organize and implement at least 2 webinars** on EU and/or US R&D opportunities for collaboration with the participation of external attendees.	Sep. 2017 - June 2018	2 webinars with 30 attendees
Support CROSSROADS Toolkit	**Update the projects and the events databases**, available through the CROSSROADS toolkit	June 2017 - June 2018	Big Data section of the CROSSROADS toolkit updated
Success Stories	**Collect at least 2 success stories on EU-US Big Data** collaboration and make available through the CROSSROADS toolkit	June 2017 - June 2018	2 Success Stories produced and disseminated
EU-US Big Data Public Event	**Organise a EU-US Big Data Public Event open for public**	Nov. 2017 - May 2018	Participation of at least 30 attendees
3rd Expert Group Meeting	**Organise the 3rd Expert Group Meeting in conjunction with the Public Event, with the participation of both the Permanent and the External Members**	Nov. 2017 - May 2018	Participation of most Permanent and External Expert Group Members
Strategic EU-US Initiatives design	**Suggestion of strategic EU-US initiatives proposals** related to the enhancement of collaboration in Big Data between EU and US	June 2017 - Apr. 2018	Suggestion of at least 1 strategic EU-US initiatives proposal
Animate 3 Internal Working Groups	**Animate the 3 Internal working groups between US BDHubs, NSF, BDVA and PICASSSO**	June 2017 - June 2018	Production of White Papers, Roadmaps for collaboration, joint events, etc.

3. Report of the Expert Group on IoT/CPS

3.1. Meeting Objectives

The 2nd EG meeting was focused on the validation and refinement of the main achievement of the IoT/CPS Expert Group in the first 18 months of the PICASSO project, the IoT/CPS opportunity report. The main objectives of the meeting were:

- **Discuss**, **validate**, and **refine** the analyses and technology themes given in the IoT/CPS opportunity report, and in particular to **prioritize to identify the most promising key technology themes** for EU-US collaboration.
- **Discuss**, **validate**, and **refine** the concrete proposals for EU-US collaboration actions, with the goal to come up with a few **key proposals** that will have the highest impact and the highest likelihood of success. Future work of the EGs will focus on these proposals.
- Discuss and finalize the **action plan** for the IoT/CPS Expert Group for the remainder of the PICASSO project.

3.2. Meeting Agenda

The meeting took place in the afternoon of June 20, 2017, in the McNamara Alumni Center, University of Minnesota. The agenda is given in the following table:

16:15 – 16:30	**Opening and Round of Introductions**
16:30 – 17:30	**The IoT/CPS Opportunity Report** • Overview and discussion of the drivers, enabling technologies, application sector analyses, and technology themes presented in the IoT/CPS opportunity report • Prioritization of the promising IoT/CPS technology themes for EU-US collaboration presented in the opportunity report
17:30 – 18:40	**The IoT/CPS Opportunity Report (ctd.) & EG Activities until the End of PICASSO** • Discussion and revision of EU-US collaboration opportunities presented in the IoT/CPS opportunity report • Discussion of and brainstorming on promising directions of work of the IoT/CPS Expert Group until the end of the project, based on a draft version of the action plan • Finalization of the IoT/CPS EG action plan
18:40 – 18:45	**Summary and Farewell**

3.3. Meeting Participants

The meeting was attended by most members of IoT/CPS Expert Group, including a recently added member to strengthen the IoT representation in the EG, Dr. Martin Serrano:

Name	**Organization** Position
Sebastian Engell EG chair	**TU Dortmund, Germany** Head of the Process Dynamics and Operations Group (DYN), Dept. of Biochemical and Chemical Engineering, IFAC Fellow, President of the European Control Association, ERC Advanced Investigator Grant holder, coordinator of several EU projects
Tariq Samad EG co-chair	**Technological Leadership Institute, University of Minnesota, USA** Senior Fellow, Honeywell/W.R. Sweatt Chair in Technology Management, Director of Graduate Studies, IEEE Fellow, Editor-in-chief of IEEE Press, Chair of the IFAC Industry Committee
Chris Greer	**National Institute of Standards and Technology, Dept. of Commerce, USA** Senior Executive for Cyber-Physical Systems, Director of the Smart Grid and Cyber-Physical Systems Program
Martin Serrano	**Insight Centre for Data Analytics, Ireland** Principal Investigator & Data Scientist
Christian Sonntag EG manager	**TU Dortmund, Germany** Senior Researcher & Project Manager
Haydn Thompson	**THHINK Group of Companies (UK, NL, JP, AUS) and Haydn Consulting Ltd.** Managing Director/Owner/Director, BILAT Advisor for Transport
O. Sinan Tumer	**SAP Co-Innovation Lab, USA** Senior Director
Hubertus Tummescheit	**Modelon, Sweden and US** CEO & Co-founder, CEO of the US subsidiary

3.4. Outcomes

The main technology and application drivers, enabling technologies, comparisons of EU and US RDI priorities, and collaboration barriers in the IoT and CPS sectors that are presented in the IoT/CPS opportunity report were discussed and agreed on, and the participants provided additional input during the discussion. The application sector smart agriculture is now an important topic in the EU, and ethics was mentioned as an important aspect in IoT/CPS. It was stated that almost all IoT/CPS challenges are cross-cutting, and it was

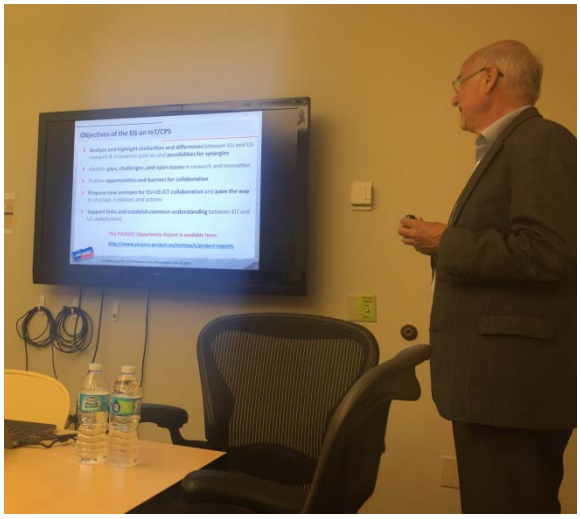

Figure 3: Sebastian Engell kicks off the 2nd IoT/CPS EG meeting.

recommended to extend the scope of some of the challenges in the IoT/CPS opportunity report to other application sectors. For instance, predictive maintenance not only covers production, but also energy and transportation, supply chain integration is an important challenge for production, and system-wide management and coordination (in the form of traffic management) is seen as important for transportation and smart cities.

It was agreed that the 6 technology themes that are defined in the IoT/CPS opportunity report are of high relevance. For EU-US collaboration, the topics and themes with the highest priority were identified to be:

- **Trust, (cyber-)security, robustness, resilience, and dependability** (including the topics of fault detection and mitigation, trustworthiness of technical systems, behavior-based methodologies for trust, new engineering perspectives, and secure real-time and mixed-criticality systems)
- **Humans in the loop** (including the topics of modeling humans, collaborative decision making, analysis of user behavior, and analysis, visualization, and decision support)
- **Model-based systems engineering** (including the topics of integrated, virtual, full-life-cycle engineering, high-confidence CPS, validation, verification, risk analysis and risk management, and models of heterogeneous large-scale systems)

The IoT/CPS opportunity report contains three proposals for EU-US collaboration actions, with EU and US agencies and industry associations as the major targets. The first step in future EU-US collaboration measures in the areas of the IoT and cyber-physical systems should focus on roadmapping and the identification, assessment, and promotion of benefits, preferably using joint, thematic EU-US workshops. Secondly, organizations are needed that serve as a central contact points, coordinators, and facilitators of collaboration initiatives. These organizations also should provide administrative, legal, and organizational assistance to interested EU and US entities. In addition, lightweight joint research and innovation initiatives are recommended that promote and support EU-US collaboration, such as coordinated calls, project twinning, fellowship and exchange funding, joint experimentation, and infrastructure sharing. These proposals were discussed in detail and will be refined accordingly in the next version of the opportunity report. Comments included that facilitation efforts are needed for collaboration initiatives, that government-government interactions are essential to set up collaboration actions, that industry-focused collaboration measures should focus on flexible instruments that support both, long-term and shorter RDI projects, and that lightweight collaboration measures could include Marie Curie programs. In addition, it was stated that investigating the possibility to involve US partners more closely in EU projects (possibly including suitable funding) may be worthwhile to stimulate EU-US collaboration in the future.

Based on these discussions, the action plan of the EG for the remainder of the PICASSO project was finalized (see below).

In conclusion, the meeting led to focused, fruitful discussions between all participants that helped to further establish a common understanding of the drivers, challenges, and opportunities on both sides, and to identify and refine the proposals for collaboration actions that were presented in the IoT/CPS opportunity report.

The main results from the meeting are:

- Discussion and revisions of the analyses and technology themes presented in the IoT/CPS opportunity report
- Discussion and revisions of the EU-US collaboration opportunities presented in the IoT/CPS opportunity report
- Finalization of the EG action plan for the remainder of the project (see next section)

3.5. Action Plan Summary

The following table summarizes the action plan of the IoT/CPS Expert Group for the remainder of the PICASSO project. The main activity will be to organize a public working meeting in the first half of 2018 that aims to attract enthusiastic experts in the relevant areas. More details are given in the PICASSO report "Action Plan of the PICASSO Expert Groups".

Activity	Activity Description	Time Frame	Success Criteria
Organization of a working meeting, along with the 3rd EG meeting	**Organization of a trans-Atlantic working meeting in the spring 2018 (along with the 3rd EG meeting)** - aligned with a public event. • Foster common EU-US understanding, present and discuss the state of the art and the challenges for the specific technology topics identified in the opportunity report • Follow-up informal meeting of representatives of EC and US agencies will be investigated to discuss collaboration options	July 2017 - June 2018	1 working meeting & 3rd meeting of EG organized
Promotion/ dissemination of collaboration opportunities	**Monitoring and dissemination of calls for collaboration** in upcoming H2020 Work Programme 2018-2020	July 2017 - June 2018	Dissemination of relevant information
Investigation of strategic initiatives	**Investigation of strategic EU-US initiative proposals, for example:** • Recommendations on topics for exclusive collaboration EU-US, targeting EU and US agencies • Recommendations for standardization activities that facilitate interoperability, targeting international standardization initiatives and relevant agencies	July 2017 - April 2018	At least 1 strategic proposal made
Measures for community enhancement	**Continued engagement** of EG experts in activities, dissemination, contributions to PICASSO outlets and CROSSROADS tool, contribution to webinars	July 2017 - June 2018	Contributions to PICASSO community enhancement
Contribution to the organization of the final PICASSO event (IoT/CPS perspective)	The objective of the final PICASSO event is to expose the PICASSO experiences, and to highlight project outcomes, lessons learnt and recommendations. All expert groups will contribute content to this event	Feb. 2018 - June 2018	IoT/CPS content contributed to final event
Finalization of the	Revision and finalization of analyses and proposals	Feb. 2018 -	Updated opportunity

opportunity report	based on results of the EG activities	June 2018	report on IoT/CPS

4. Report of the Expert Group on 5G

4.1. Meeting Objectives

The 2nd 5G expert group meeting took place on June 20th in Minneapolis. The objectives of this meeting were to

- **Refine** and **validate** the **opportunity report**.
- **Recommend technology themes and research topics** for EU-US collaborations in 5G network domain.
- **Identify upcoming call(s)** where the 5G Expert Group can take concrete actions.
- **Discuss** and **brainstorm concrete action steps/plans** for the next year.
- **Discuss feasible sustainability plans** for the 5G expert group after the PICASSO project.

4.2. Meeting Agenda

The meeting took place in the afternoon of June 20, 2017, in the McNamara Alumni Center, University of Minnesota. The agenda is given in the following table:

16:15 – 16:30	**Opening and Round of Introductions**
16:30 – 17:30	**The 5G Opportunity Report: Drivers, Needs, Opportunities, and Collaboration Proposals** • Overview of challenges, themes, opportunities, and proposals • Discussion and feedback • Identify technology theme and topics for EU-US collaborations based on the opportunity report and 5G session in the Minneapolis symposium
17:30 – 18:40	**Discussion and Brainstorming: Action/sustainability plans for 5G EG members** • Discussion of an upcoming call on EU-US 5G collaboration in H2020 program in spring 2018 • Discussion of a concrete timeline and action points for submission based on the identified 5 research topics • Devise a 5G EG action roadmap that integrates all the EG internal activities, external public dissemination activities, as well as an actual call submission • Special discussion on the US 5G landscape as requested by the European Commission 5G Unit. Identification of responsible person for collecting corresponding information
18:40 – 18:45	**Summary and Farewell**

4.3. Meeting Participants

The meeting was attended by both, permanent and external members of 5G Expert Group:

Name	Organization Position
Gerhard Fettweis EG chair	**TU Dresden, Germany** Vodafone Chair professor, **IEEE Fellow**, member of acatech, **Coordinator** of 5GLab Germany, **Coordinator** of Cluster of Excellence cfaed and HAEC, **Co-chair** of the IEEE 5G Initiative Steering Committee, **Co-founder** of 12 high-tech start-ups
Olav Queseth	**Ericsson, Sweden** Senior researcher in Ericsson Research, **Project coordinator** for EU/5GPPP project METIS-II
Ari Pouttu	**Oulu University, Finland** Professor, **Research director** of centre for wireless communications Oulu
Amitava Ghosh	**Nokia, USA** **Nokia Fellow**, **Head** of Small Cell Research, **IEEE Fellow**
Yaning Zou EG manager	**TU Dresden, Germany** Researcher, Vodafone Chair

4.4. Outcomes

Despite strong competition and different views on 5G between the EU and the US, the attending EG members agreed that there is a strong synergy on technologies that have **niche market shares**. By strategically combining R&I capabilities of both sides, commercially viable and profitable solutions can be developed with reasonable cost on each side. The developed solutions will eventually benefit niche markets inside the EU and US as well as similar markets in the rest of world.

Applying this niche market strategy, **5 research topics** were identified, some of which have been discussed in the opportunity report. The topics are:

- Ultra Large Cell
- Small Cell
- V2X
- Fragment IoT
- Satellite

Clearly, the next step would be to turn the knowledge of 5G expert group into actions. In this context, a concrete roadmap was devised in the 2nd expert group meeting leading to activities that span from June 2017 until mid-2018 and beyond.

The major target is to prepare and submit a **project proposal** based on the identified topics by the 5G EG to a possible upcoming call in the spring of 2018 on EU-US 5G collaboration. We consider such a target to be the best and most efficient way to continuously engage the expert group and disseminate outcomes of the project.

The main results from the meeting are:

- Validation of the opportunity report
- Validation of the recommendations on technology themes and research topics
- Roadmap of the 5G expert group including the following aspects:
    - Action plan
    - Sustainability plan
    - Proposal for strategic initiative targeting on policy makers
    - Dissemination plan

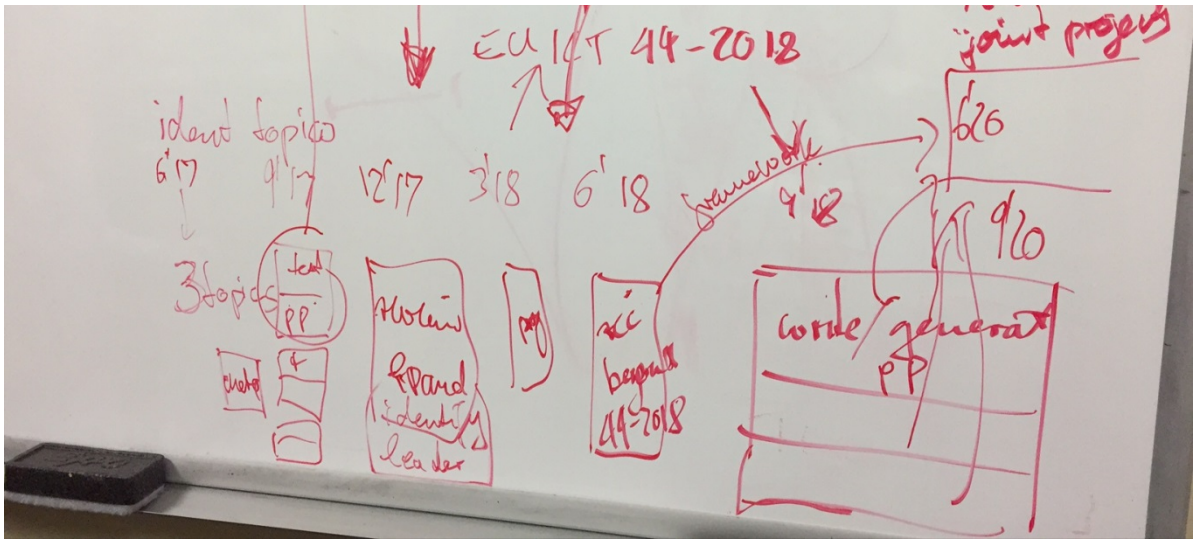

Figure 4: Roadmap of 5G Expert Group for the next year and beyond.

4.5. Action Plan Summary

In the 2nd expert group meeting, instead of devising a separate action plan, sustainability plan, and dissemination plan, 5G experts came up a step-by-step **roadmap that integrates all the essential action elements together**, as shown in Figure 4. The near-future goal is to submit a project proposal to an upcoming H2020 call on EU-US collaboration. In the following, we briefly **summarize the important milestones**. More details are given in the PICASSO report "Action Plan of the PICASSO Expert Groups".

Due Date	Activity Description	Success Criteria
June, 2017	**Identify technology theme and 5 research topics**	Decisions on Topics (done)
Sep., 2017	**Draft an overview on the technology theme**. **Describe each research topic and identify potential partners**. Internal review in 5G expert group.	A draft of technology theme summary and descriptions of selected topics
Dec. 2017	**The 3rd Expert Group Meeting. Identify leader for each research topic**. Internal review in 5G expert group.	Participations of experts and names of identified

		leaders
Mar. 2018	**Submit project proposal** for EC call.	One proposal is submitted before the deadline
April/May 2018	**Organize a public workshop** in conjunction with, e.g., ICC 2018, to disseminate outputs of 5G expert group.	High-level speakers and good attendance.
April 2018	End of PICASSO project, **propose initiative strategies to policy makers** on EU-US collaboration models, e.g., EC, on the FP9 and NSF.	The proposal is submitted to the EC
May/June 2018	**Co-organize** the last event with partners in the PICASSO consortium.	High-level speakers and good attendance
Sep. 2018 and beyond	If proposal is successful, 5G EG will **collaborate on the topics proposed in the PICASSO project** and **define detailed technical specifications and perspective solutions for EU-US collaborations**.	The PICASSO 5G expert group continues

In addition to the execution of the devised roadmap, the 5G expert group also agreed to **carry out the following actions over the next year**:

Timeline	Activity Description	Success Criteria
July 2017 - June 2018	**Update the opportunity report** based on the discussions on the related aspects from the 5G expert group	Updated opportunity report for 5G
July 2017 - Aug. 2017	Deliver a detailed analysis on **the landscape of 5G research in US**	A report on US 5G funding landscape is written and sent to the EC 5G unit.
July 2017 - June 2018	**Support** and **provide** inputs to the CROSSROADS toolkit	Updated CROSSROADS tool kit from the 5G perspective
Jan. 2018 - June 2018	**Organize** a webinar based on the updated opportunity report	Good attendance in the webinar

5. Report of the Expert Group on Policy

5.1. Meeting Objectives

The 2nd ICT Policy expert group meeting took place on June 20th in Minneapolis and was in conjunction with the Trans-Atlantic Symposium on ICT Technology and Policy. The objectives of this meeting were to

- **Review the policy landscape** in which EU US ICT R&I collaboration takes place,
- **Review where we stand towards developing the Policy White paper** (final deliverable of the project), and in particular to the contributions hereto from the papers on **Data Protection & Privacy** and on **ICT Security** (both finalized) and **Standardization** (draft in preparation for webinar),
- Agree on a **way forward** including the focus of the upcoming policy briefs and interaction with the target groups of PICASSO.

5.2. Meeting Agenda

The meeting took place in the afternoon of June 20, 2017, in the McNamara Alumni Center, University of Minnesota. The agenda is given in the following table:

16:15 – 16:30	**Opening and Round of Introductions**
16:30 – 17:30	**Where are we, today?** • Composition and membership of the PICASSO policy expert group • Overview of the current policy landscape in which EU US ICT R&I collaboration takes place • Discussion on the finalized policy papers on Data Protection & Privacy and on ICT Security • Discussion on the draft policy paper on Standardization and on how to progress that
17:30 – 18:40	**What is to be done, next** • Discussion of upcoming policy papers (subject, pen holder, time line) • Discussion on the preparation and finalization of the Policy White Paper on EU US ICT R&I Collaboration (to be delivered by June 2018)
18:40 – 18:45	**Summary and Farewell**

5.3. Meeting Participants

The meeting was attended by the following people:

Name	Organization Position
Maarten Botterman EG chair	**GNKS Consult BV** Independent Policy Researcher, ICANN Board Director, IGF DC IoT Chairman
Dave Farber EG vice-chair	**Carnegie Mellon University** Professor (adjunct/visiting/Emeritus), Internet Hall of Fame
Jonathan Cave EG member	**University of Warwick** Senior Lecturer, Economist Member of the UK Regulatory Policy Committee
Dan Caprio	**The Providence Group** Co-Founder and Chairman, IGF DC IoT Member
Glenn Ricart	**US IGNITE** Founder and CEO
James Clarke	**Waterford Institute of Technology** Programme Manager, DISCOVERY Partner
Margot Bezzi	**Agency for the Promotion of European Research (APRE)** Senior Project Manager, PICASSO Project team
Chris Greer (first part of meeting)	**National Institute of Standards and Technology** National coordinator for Smart Grid Interoperability
Veronique Pevtschin (second part meeting)	**European Research Direction Team** Engineering Ingeneria Informatica SPA, PICASSO Project Reviewer
Jean-Yves Roger (second part meeting)	**European Commission DG CNECT** International Relations Officer, PICASSO Project Officer
Ilkka Lakaniemi EG member (per Skype)	**Finland Chamber of Commerce** Vice-President, Digital Economy and Growth

5.4. Outcomes

The PICASSO Policy Expert Group holds the policy embrace for the work done within and through PICASSO and therefore interacts with all PICASSO expert groups, the ICT Research Community and the Internet Governance Community for the wider policy issues. The experts focus on Policy Issues that particularly relate to EU/US ICT R&I collaboration in the fields of 5G Networks; Big Data; and the Internet of Things/cyber-physical systems. Policy papers have been developed on issues that are particularly relevant in this, and the first policy papers have been disseminated and discussed with multiple stakeholders from both sides of the Atlantic.

Subjects covered so far include Data Protection and Privacy, ICT Security, and Standardization. The first two papers have been finalized following a public webinar with participants with a wide variety of backgrounds, reflecting the multidisciplinary and multistakeholder character of our work. As much is happening relating to these subjects presently, we plan to update the documents, as appropriate, during early 2018.

Figure 5: PICASSO Policy expert group members Maarten Botterman, Dave Farber, and Jonathan Cave

Key messages resulting from the work of the PICASSO Policy expert group relating to the PICASSO domains are:

1. Data Protection & Privacy

   - 5G networks: sensors and tracking will become even more ubiquitous than it is today, as networks will be designed with a focus on data collection and exchange. As such, EU/US policies do not seem to directly affect the ability to collaborate in 5G networks ICT research and innovation.
   - Big Data: challenges go two ways: <1> personal data may not be shared unless it is set up to be shared by explicit intent and consent; <2> through use of algorithms and big data, data could become related to private individuals that were never intended to be "personal". Here, a clear link to intent/consent will need to be respected in order to ensure big data services to operate in a legal way.
   - Cyber-physical systems and the Internet of Things: CPS do not aim to sense/track an individual, yet a relationship may be incurred. It will be very important to determine which data is privacy-sensitive, and how it relates to intent and consent – as IoT as such is a big data generator.

2. ICT Security

   - 5G networks: the main challenges will be escalation and fragmentation; development is producing a hyperconnected world that makes a very attractive target for good and bad behavior, while network slicing makes it possible to define different logical networks with distinct own levels of security.
   - Big Data: the key challenge is to secure data against unauthorized access and tampering. At the same time, big data analytics can help with early detection and prevention of attacks and breaches.
   - Cyber-physical systems and the Internet of Things: there is a further element of complexity that needs to be addressed; in order to reduce the overall level of complexity and ensure appropriate measures are taken for specific IoT applications, participants noted the need for a security taxonomy for development of ICT-based technologies and services and pointed out

that outdated security models need to be adapted to become more proactive, and more inspired by biology[4].

These papers, as well as the draft paper on Standardization, are seen as fundamental for the work to be done and providing excellent input towards developing a wider policy background and action initiatives. With regards to Standardization, it was seen as important to also look at standards on how to communicate with users on aspects of privacy and security, as to come to "meaningful consent". Also the role of open source is worth further consideration, taking into account reputational and functional risks: risks that are to be managed. With regards to Security, it was remarked that in the trade-off between security and power use a certain minimum level of security should be reached, and a further consideration on certification and labeling should come with that.

Next to finalization of the Standardization paper, two more papers are to be developed before the end of 2017, to form together a solid basis for the Policy White paper which is to present recommendations for specific high-potential ICT policy initiatives in the EU/US dialogue, resulting from the work done over the lifetime of the project. Taking into account that our focus in IoT is on CPS, Industry 4.0 seems to be a solid subject for one of those two papers. Ilkka Lakaniemi is willing to hold the pen on this, and will propose an outline shortly. This should not only consider the techno-economic aspects but also the regulatory policy context including self-regulation vs. regulation; and the realization that the socio-economic context is not only about the impact on GDP but also about jobs: a particularly important subject when considering robotization, machine learning and eventually artificial intelligence. In this there is a recognition that in the end it is all about a collective enhancement of quality of life.

As for the second paper to be developed two potential subjects came up: "Spectrum" (in particular relevant for 5G and IoT) or "Smart Communities" (where many things come together). Rather than deciding on the spot, Glenn Ricart volunteered to write a short outline for the "Smart Communities" paper, and Jonathan Cave for "Spectrum"-after which the Policy Expert Group would convene to determine which paper to further develop.

5.5. Action Plan Summary

Timeline	Activity Description	Success Criteria
July 2017 - Dec. 2017	**Finalize policy paper on Standardization** and include a webinar on the full draft paper in September 2017	High-quality participation in webinar to discuss full draft, and high-quality policy paper
July 2017 - Dec. 2017	**Develop a policy paper on Industry 4.0 (working title)** and include a webinar on the full draft paper in October/November 2017	High-quality participation in webinar to discuss full draft, and high-quality policy paper
July 2017 - Dec. 2017	**Select the subject for a policy paper, and develop that**	Agree on topic, develop

[4] Researchers look to natural systems for inspiration and methods to solve problems in human-created artificial complex environments such as IoT ecosystems. This has resulted in the development of evolutionary algorithms including genetic algorithms and swarm algorithms, and of classifier and pattern detection algorithms, such as neural networks, for addressing hard computational problems and detecting anomalies, thus enabling protection up and beyond recognition of security breach patterns that are already known.

	policy paper and include a webinar on the full draft paper in October/November 2017	solid draft paper, webinar with high-quality participants, and final policy paper
Jan. 2018 - Mar. 2018	**Review and update all 5 policy papers**	Review all policy papers and add relevant updates, where necessary (NB: in particular for 1,2 and 3 as 4 and 5 are finalized towards the end of 2017)
Jan. 2018 - June 2018	Develop a Policy White Paper for presentation at the PICASSO final conference	Short yet high-quality paper with clear policy finding and recommendations

6. Conclusions and Future Plans

The four meetings of the PICASSO Expert Groups on Big Data, IoT/CPS, 5G, and Policy that were held in conjunction with the public *Trans-Atlantic Symposium on ICT Technology and Policy* that was organized by the PICASSO project in Minneapolis, USA, on June 19/20, 2017, achieved all of their objectives and led to focused, fruitful discussions between all participants that helped to further establish a common understanding of the drivers, challenges, and opportunities on both sides, to identify and refine the proposals for collaboration actions, and to plan the activities of the EGs for the remainder of the project.

In addition to other activities, all technology Expert Groups are planning to organize public meetings in conjunction with the 3rd EG meetings in the first half of 2018, which may be attached to suitable larger international events to attract large relevant audiences and thus maximize the impact of the meetings. All EGs will contribute to the organization of the final public PICASSO event at the end of the project. As this event was proposed to be in the US at the project review, this may lead to a change of plans with respect to the public EG meetings. All technology EGs will investigate and propose potential strategic EU-US initiatives, will continue their community enhancement activities (including e.g. organization/contribution of/to webinars, support of the CROSSROADS tool, development of success stories, dissemination), and will revise the opportunity report based on results of the EG activities at the end of the project.

The policy EG plans to finalize the draft policy paper on standardisation and organize a related webinar, develop the fourth and fifth policy paper (on Industry 4.0 and on a topic that is still to be identified), and based on these efforts develop the final Policy White Paper on EU-US Policy collaboration for presentation at the PICASSO final event.

7. References

1. **Thompson, Haydn.** *First Expert Group Meeting Report, Washington D.C.* 2016. Available at: http://www.picasso-project.eu/outreach/.

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