Towards a European Roadmap on Research and Innovation in Engineering and Management of Cyber-Physical Systems of Systems

Project Deliverable

Project Number:	Project Acronym:	Project Title:
611115	CPSoS	Towards a European Roadmap on Research and Innovation in Engineering and Management of Cyber-Physical Systems of Systems

Instrument:	Thematic Priority
COORDINATION AND SUPPORT ACTION	ICT

Title

D4.5 Report on the use and dissemination of knowledge, with results of the project communication and dissemination campaign

Due Date:	Actual Submission Date:
Month 33 (June 2016)	July 1st, 2016

Start date of project:	Duration:
October 1st, 2013	33 months

Organization name of lead contractor for this deliverable:	Document version:
inno TSD	V1.0

Dissemination level (Project co-funded by the European Commission within the Seventh Framework Programme)

PU	Public	**X**
PP	Restricted to other programme participants (including the Commission)	
RE	Restricted to a group defined by the consortium (including the Commission)	
CO	Confidential, only for members of the consortium (including the Commission)	

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Abstract :

This report was prepared to provide details of project communication and dissemination activities (Workpackage 4) of the project. The work was done according to the communication and outreach strategy elaborated at the beginning of the project. The strategy aimed at assuring effective communication about the project and its outcomes and thus to promote the project and maximise its impact.

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Keywords :

Information, awareness, use and dissemination of knowledge, outreach, impact.

Disclaimer:

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Revision History

The following table describes the main changes done in the document since it was created.

Revision	Date	Description	Author (Organisation)
V0.1	16/06/2016	Creation	Dagmar Marron (inno)
V0.2	20/06/2016	Contribution	Svetlana Klessova (inno)
V0.3	21/06/2016	Update	Dagmar Marron (inno)
V0.3	21/06/2016	Review and Final Contributions	Svetlana Klessova (inno)
V1.0	30/06/2016	Final Review	Sebastian Engell (TUDO)

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Acronyms and Definitions

Acronym	Defined as
CPSoS	Cyber-physical Systems of Systems
DoW	Description of Work
EC	European Commission
FP7	7th Framework Programme of the European Commission
H2020	EU Framework Programme for Research and Innovation Horizon 2020
ICT	Information and Communication Technology
IoT	Internet of Things
MEP	Member of European Parliament
SoS	Systems of Systems
WP	Work Package

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1. Executive Summary

The CPSoS project has, during its entire lifetime, continuously communicated on activities conducted and results achieved, covering many communities relevant for and possibly interested in the project, both in countries where the consortium partners are operating and worldwide. The communication activities followed the approach and used the tools defined at the beginning of the project in the Communication and Outreach Strategy, assuring effective communication about the project and its outcomes with the aim to promote the project and maximise its impact.

The objective of the dissemination activities were two-fold:

- To promote the progress and results of the project in the relevant communities
- To increase the impact of the findings not only of CPSoS, but also of three other ongoing FP7 funded projects on SoS (DYMASOS, AMADEOS, Local4Global), each of them addressing few topics within the broad range of important issues in the engineering of Systems of Systems

The CPSoS Workpackage 4 (WP4) defined the plans, the roles, and the responsibilities of the partners for the project branding, awareness raising and dissemination activities. The communication and dissemination campaign lasted during the whole project life cycle and the project website will be kept at least for a further 2 years period after project completion. inno TSD, in its function of the WP leader, was in charge of the implementation of the communication campaign, including the creation of a visual identity, publicity and promotion material, and set up and updates of the project website. All other project partners were involved in the communication and dissemination activities.

The communication & outreach activities targeted the following audience for CPSoS:

- **Research and industrial communities:** Systems and control, embedded and cyber-physical systems, computer science, simulation and verification tools, advanced network and communication technologies, and industrial users, as well as R&D communities interested in development of SoS and in roadmapping on the topic.
- **General public:** The aim was to raise awareness of the importance of CPSoS and their proper engineering and management, in order to create an understanding of the benefits of SoS technologies and the challenges within this audience group as well.

The communication of the project was based upon a common visual entity. A consistent visual chart (colours, fonts, designs) was derived from the project logo and provided in several shapes and formats (document templates etc.). This visual identity was used extensively throughout the project, creating a distinguishable brand that is now recognized in the SoS communities.

A variety of promotion and publicity tools was used to achieve the objectives of the project. For each communication opportunity the tools and messages were adjusted to the targeted audience. Project partners used diverse promotion channels, such as the project web site, press and media articles, newsletters, PowerPoint presentations, flyers and posters. All publicity material followed the CPSoS branding, defined at the start of the project.

Promotion and publicity activities and tools were:

- Set-up and update of the project web site
- Editing and publication of 4 e-newsletters, containing contributions and information about the 4 projects funded under the same SoS topic (edited by the CPSoS project)
- Networking with other SoS cluster projects (CPSoS, AMADEOS, Local4Global) and organization of joint workshops
- Social media presence via LinkedIn

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- Publication of press releases and news
- Publication of Project Event related summaries and presentations on the project website
- Participation in major events and conferences of interest to the project
- Contribution to awareness raising activities done by other SoS projects
- Organisation of public events in conjunction with Working Groups
- Editing, publication and distribution of a Working Paper "Cyber-Physical Systems of Systems: Research and Innovation Priorities"
- Editing, publication and distribution of a "Proposal of a European and Innovation Agenda on Cyber-physical Systems of Systems 2016-2025"
- Publication of the materials (technical papers supporting the policy proposals) in a book (will be done after the end of the project)
- Organisation of two final events, one addressing academics rather, the other designated to industrial stakeholders.

Partners, Working Group Members, as well as the other three SoS cluster projects were stimulated to use their network for communication about the CPSoS project activities and results.

In terms of numbers, the following measurable and verifiable performance indicators have been fixed in the DoW (Part B).

Activities facilitating community networking, dissemination and awareness raising	→ Public events (at least 30+ participants per event on the average)	4	At least 120+
	→ Symposium ""Cyber-physical Systems of Systems Meeting Societal Challenges" (jointly with other support actions related to CPS and SoS)	1	At least 75+ (130+ if joint event with other support action)
	→ Number of overall participations in the public events organized by CPSoS		At least 200+
	→ Coordination with SoS related projects	5+ projects	
Awareness raising and dissemination activities	→ Web site	1	Wide community (500+)
	→ Newsletters	4	
	→ Presentations at other events	15	
	→ General articles	3	

Table 1 - Measurable Performance Indications (Dissemination and Awareness Rising)

Results obtained:

	planned	realized	reached
Public events:	4 events, total 120+ participants	5 events, 125+	yes
Final event(s)	75+	70-80	yes
Number of overall participation in project events	200+	300+	yes
Coordination with SoS related projects	5+ projects	9+	yes
Website	1	1	yes

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Newsletters	4	4	yes
Presentations at other events	15+	30+	yes
General articles	3	4	yes

Details are provided in the following chapters of this report.

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2. Introduction

CPSoS, a 33-months Support Action funded by the EC (FP7 programme), has provided a forum and an exchange platform for systems-of-systems related projects and communities. It has focused on challenges posed by the engineering and the operation of technical systems in which computing and communication systems interact with large complex physical systems. Its approach was simultaneously integrative, aiming at bringing together knowledge from different SoS related communities and applications driven. It has bridged between the different approaches to the design, analysis and control of Systems of Systems (SoS) that are pursued by different communities in theory and applications and related the methods and tools proposed for dealing with SoS to key application domains which are important for Europe's competitiveness as well as for the well-being of its citizens. The project has examined in-depth application-specific issues, captured cross-industry and cross-application findings and proposed new avenues for SoS analysis, design and control, towards a science of domain experts, end-users and vendors.

The CPSoS project has prepared a Working Paper on 'Core Research and Innovation Areas in Cyber-physical Systems of Systems', outlining the challenges and key research and innovation areas in the domain of large systems that consist of physical structures and information processing elements, underpinned by a report on 'Analysis of the State-of-the-Art and Future Challenges in Cyber-physical Systems of Systems'. Both documents were widely distributed, published on the project website, and a public consultation was organised.

The resulting project findings have, at the end of the project, been summarised in an illustrated strategic policy document "European Research and Innovation Agenda on Cyber-physical Systems of Systems", and were presented at two workshops at the CPS Week in Vienna and at the Hannover Fair.

Throughout the project lifetime, information about the activities conducted and insights and knowledge gained, were published, following the CPSoS Communication & Outreach Strategy.

This document summarises the activities and results of the CPSoS project communication and dissemination campaign, and reports on the use and dissemination of knowledge.

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3. Dissemination Materials, Activities and Channels

CPSoS Branding

During the first three months of the project, the **CPSoS branding** has been defined in order to make the project easily recognisable. It has become a stable visual element for project presentations and promotion.

The branding pack prepared by inno and used by the project partners includes:

Project logo and visual identity

The project logo has been designed by a professional designer based on proposals from the partners of the consortium and has been agreed on by the partners. The logo has been designed to be easily recognisable and to be meaningful to technical people, letting the technical concept of the project shine through.

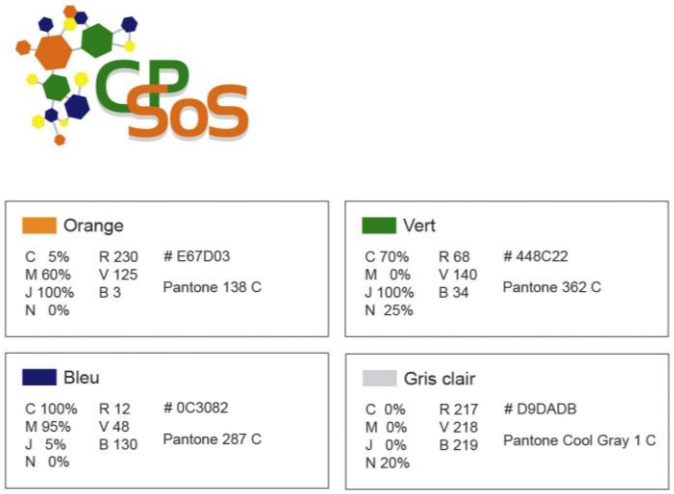

Figure 1 - CPSoS Visual Identity

Different versions of the CPSoS logo have been produced, adapted to different backgrounds and displays (screen, print, black and white). The logo is available both in pixel and vector formats, and also available for the partners' use via the project shared platform.

Graphical templates

A set of graphical templates (Word and PowerPoint) has been designed in order to ensure a professional level of quality in terms of design and presentation in all the project documents and communications.

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Figure 2 - CPSoS Graphical Templates

CPSoS Website

The first version of the CPSoS website was available in month 4 and was continuously updated as the project advanced.

The CPSoS website represents the first vehicle in raising awareness of the project and contains a general presentation of the project objectives, the consortium and the Working Groups. Interested users can find news of the project and access to publications, deliverables, information on events etc. It follows the CPSoS branding and played an important role in the information campaign. It was updated all along the project lifetime with latest results and findings. The website will be kept at least for a further 2-years period after project completion.

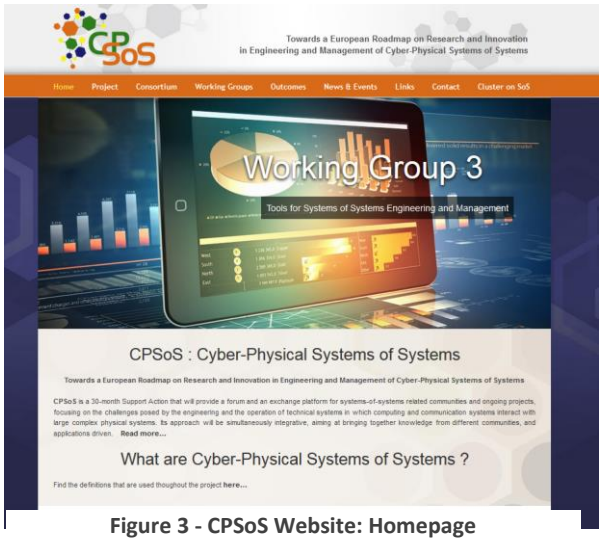

Figure 3 - CPSoS Website: Homepage

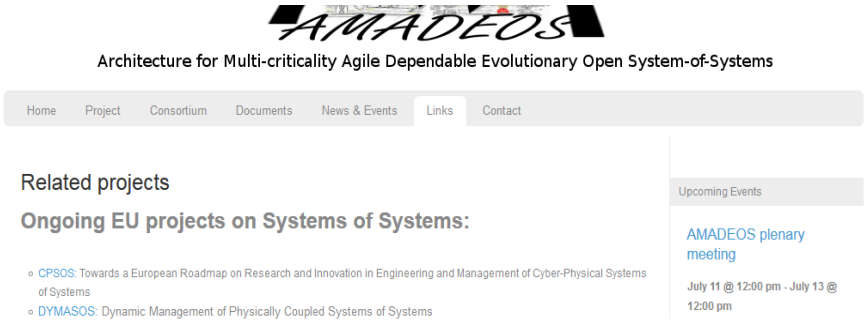

Figure 4 - CPSoS Promotion on AMADEOS Website

Promotion of the CPSoS project was also done through other relevant web portals, such as

- AMADEOS
- DYMASOS
- Local4Global
- CyPhERS and
- TAMS4CPS,

in order to create synergy effects.

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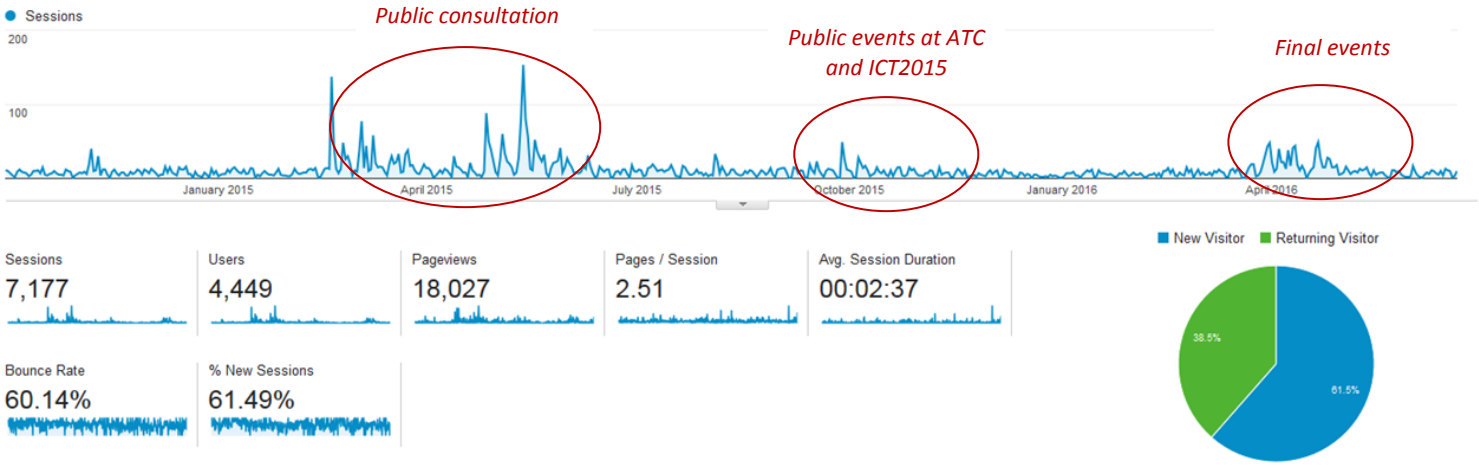
The Website was designed using responsive web technologies to enable optimum visualization independently of the targeted device (PC, tablet, and mobile).

Some website statistical information (entire project period):



The "peaks" of the statistics clearly shows the higher connections of users in relation with the specific dissemination activities of the CPSoS project, such as public consultation, or events.

CPSoS Leaflet

A CPSoS leaflet was created in month 12 (September 2014), after discussion at a plenary meeting with the SoS cluster projects, and was used to present the project, its goals and the consortium, the concept of cyber-physical systems of systems in a graphical form, as well as to point to the other SoS cluster projects. Further, information about the identified research and innovation challenges was provided.

It also was used to facilitate first contact with targeted stakeholders – ICT experts, national and local authorities, stakeholders, media representatives, etc. - and to attract attention to the project and its website.

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Figure 5 - CPSoS Leaflet, initial version (M12)

The leaflet was later updated to include information about major outcomes and results in month 25 (October 2015). The second version is shown below. It was printed in 300 copies. Around 200 of these were distributed since then, whereas the remaining ones shall be distributed at the occasion of further events, such as ECC'16.

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Figure 6 - CPSoS Leaflet, updated version (M25)

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The flyers were distributed at physical meetings, workshops and events which partners of the CPSoS project organized or attended. Electronical versions were made available for consultation and download in the Publication Repository (Outcome Section) of the project website (http://www.cpsos.eu/outcomes/publications/).

Project Poster

A project poster was available in August 2014 and ready for use in time for the first public events linked to the CPSoS Working Groups.

Figure 7 - CPSoS Project Poster

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CPSoS Project Presentation Slides

Following the CPSoS branding, a **generic CPSoS PowerPoint presentation** has been developed and was used for awareness-raising and information at events as well as via the partner's networks. It was used by all persons involved in the project to disseminate the project objectives, its status and the expected results.

It further could easily be adapted by partners for specific audiences and/or new information. It first detailed the structure of the project in terms of objectives, main results that the project aims to achieve and the tools the project will use. As soon as scientific content was available (recommended priorities, etc. ...), it was added to the presentation.

Figure 8 - CPSoS Project Presentation

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Newsletters

CPSoS has initiated, coordinated and edited four "Cluster of EU FP7 Projects on Systems of Systems"-newsletters. Each issue included contributions from the four projects being part of the "European Systems of Systems Research and Innovation Cluster" and was widely circulated in order to raise awareness and disseminate information about the projects.

The contribution to these newsletters presented the cluster project's key objectives, activities' progress and main outcomes, as well as information about project or other related events.

The newsletters were dispatched to the relevant communities by all CPSoS partners via the following channels:

- The cluster projects' websites - as downloadable PDF files or via a link to the related CPSoS webpage (http://www.cpsos.eu/news-events/newsletters/).

- Direct mailing to the CPSoS Working Group Members
- Direct mailing to a list, set up via a 'subscribe' function made available on the CPSoS website (nearly 130 subscribers at the end of the project)
- Direct mailing to a list of participants in the public events linked to the Working Group meetings (over 20)
- Distribution via the individual networks of the projects' partners
- LinkedIn distribution

Figure 9 - SoS Cluster Newsletter

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Social Media Communication Strategy

Social media can be a strong tool to disseminate the project results and engage in communication with the community. However, social media makes sense only if there is a community commitment and if the targeted media are carefully chosen. CPSoS has set up a LinkedIn Group, but the team received recommendations from the users to channel the information through existing, well established LinkedIn groups related to the topic of the project, instead of developing a new group. This strategy then was implemented by the CPSoS project.

Publications on LinkedIn groups related to Systems of Systems contributed to the visibility of the project.

Information was posted via the following LinkedIn groups (NB: membership in June 2016):

- Automation & Control Engineering - 106 099 members
- Embedded Systems Group - 43 866 members
- Internet of Things - 68 718 members
- Automation Engineers Technical Group - 7 548 members
- Advanced Process Control Professionals - 5 320 members
- Industrial Process Optimization - 2 848 members
- Cyber Physical Systems - 501members

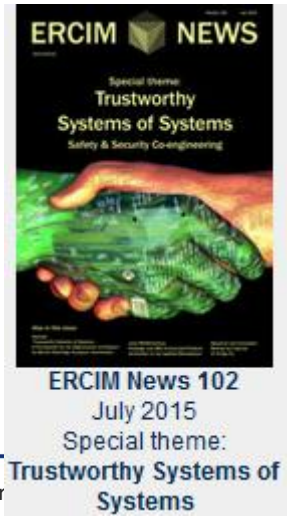
Project Communications (Press Releases)

Two Project Communications have been prepared, and were published on the CPSoS Website and circulated by the partners via their individual networks. One of them was to announce the launch of the project, whereas the second was reporting on the second, individual meetings of the CPSoS Working Groups in autumn 2014.

For further important project events and information, the strategy then was rather to post news and provide links to dedicated webpages on the project website, where more detailed information was published and presentation slides could be consulted.

Articles in Specialized Journals and Newspapers

- ERCIM News 97, 2014 – Michel A. Reniers, Sebastian Engell; A European Roadmap on Cyber-physical Systems of Systems http://ercim-news.ercim.eu/en97/special/a-europeanroadmap-on-cyber-physical-systems-of-systems
- An interview was provided for the Automotive Megatrends magazine describing some of the findings of the report and giving an overview of how cyber physical systems and systems of systems will impact the future of the automotive and logistics sector: Interview with Automotive Megatrends Magazine „Automotive Cyber-Physical systems: the next computing revolution“, Automotive Megatrends, Q3, pp 104-106, 2014 - http://automotivemegatrends.com/automotive-megatrends-magazine-q3-2014/



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- ERCIM News 102, 2015 – Michel A. Reniers, Sebastian Engell, Haydn Thompson; Core Research and Innovation Areas in Cyber-Physical Systems of Systems - http://ercim-news.ercim.eu/en102/special/core-research-and-innovation-areas-in-cyber-physical-systems-of-systems
- Cyber Physical Systems. Design, Modeling, and Evaluation, Springer Lecture Notes in Computer Science Vol. 9361, 40-55 - S. Engell, R. Paulen, M.A. Reniers, C. Sonntag, H. Thompson; Core Research and Innovation Areas in Cyber-Physical Systems of Systems – Initial Findings of the CPSoS Project - http://link.springer.com/chapter/10.1007/978-3-319-25141-7_4
- An interview with S. Engell on "Cyber-Physical Systems of Systems - Wie beherrschen wir die Komplexität und steuern diese Systeme?" ("Cyber-physical Systems of Systems - How to master the complexity and control these systems?') was published in SafeTRANS News 2016-01 - http://news.safetrans-de.org/Ausgabe_2016-01/SafeTRANS_Gespraeche.html#seitenkopf:safetrans-gespraeche-sebastian-engell-tu-dortmund

Proposal of a European Research and Innovation Agenda on Cyber-physical Systems of Systems – 2016-2025

Over a series of meetings and public workshops, and based on feedback from experts from small and large enterprises, the CPSoS Project has developed a "Proposal of a European Research and Innovation Agenda on Cyber-physical Systems of Systems" and published it as an illustrated brochure. The document was professionally designed and then printed. This is one of the major outcomes of the CPSoS project.

Several hundred paper copies of this high-quality brochure have so far been distributed. The brochure has also been made available for download on the project website (www.cpsos.eu/roadmap).

Most elements of the CPSoS research agenda were integrated in the Strategic Research Agenda (SRA) of the Artemis Industrial Association which contains a chapter on Cyber-physical Systems of Systems.

Public Events Organised by the Project

- **Public Workshop WG1** – Transport and Logistics: at Automotive Megatrends Europe 2014, Sept 10/11, 2014 in Brussels, Belgium.

  The 2nd Working Group Meeting of the Transport and Logistics Working Group (Working Group 1) took place in conjunction with Automotive Megatrends Europe 2014 which was held in Brussels on the 10th and 11th of September. The Conference brought together key stakeholders from industry and academia to network and debate business models, technologies and trends that will shape Europe's commercial vehicle and passenger car markets over the next ten years and beyond. The conference attracted over 100 expert speakers and 250 delegates discussing cutting edge topics including fuel economy, emissions reduction, eMobility and in-car connectivity. CPSoS sponsored the event and widely disseminated the work and outcomes of the Transport and Logistics Working Group over the two days including via a dedicated Exhibition Stand promoting the project.

  With related Advertisement in the Automotive Megatrends 2014 eMagazine (p.65): http://automotivemegatrends.com/automotive-megatrends-magazine-q3-2014/ and an exhibition stand

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at Automotive Megatrends was organised; CPSoS poster was presented and CPSoS flyers were distributed there.

Detailed information on the event is provided in Deliverable D2.1 (a) Report on the second meeting of the Working Group 1, with (b) input paper

- **Public Workshop WG2** - Physically Connected Systems: October 1, 2014 in Zürich, Switzerland

  The CPSoS Working Group 2 – Physically connected Systems of Systems organises, in cooperation with the FP7 funded project DYMASOS, a Public Workshop on "Engineering and Management of Cyber-physical Systems of Systems". 39 participants were present.

  Detailed information on the event is provided in Deliverable D2.2 Report on the second meeting of the Working Group 2, with input paper

- **First Public Workshop WG3** - Tools for SoS Engineering and Management: in conjunction with IFM 2014 on September 12, 2014 in Bertinoro, Italy;

  CPSoS Working Group 3, Tools for Systems of Systems Engineering and Management, has organised a public workshop on September 12, 2014 in Bertinoro, Italy at the occasion of IFM2014 with the aim to discuss the state-of-the-art and future challenges in the engineering of cyber-physical systems of systems. The workshop consisted of three types of presentations: invited presentations, presentations by CPSoS Working Group members and submitted presentations.

  15 participants were present and the exchanges with other participants of the conference were organised throughout the day. Detailed information on the event is provided in Deliverable D2.3 Report on the second meeting of the Working Group 1, with input paper

- **Second Public Workshop WG3** - Tools for SoS Engineering and Management: Workshop on "Tools and Methods for Management and Engineering of CPSoS", February 9th, 2015 in Eindhoven, The Netherlands

  On February 9th, 2015 a "Workshop on Tools and Methods for Management and Engineering of CPSoS", organised by CPSoS Working Group 3 (Tools for systems engineering and management), took place at TU/e, Eindhoven, The Netherlands. The purpose of this workshop was to discuss research challenges in the area of Engineering of Cyber-Physical Systems of Systems as addressed by the FP7 Support and Communication Action CPSoS.

  The program was composed of presentations by members of Working Group 3, representatives of local industry as well as a presentation and discussion of the research challenges that have been identified by the project.

  In total 31 participants from different backgrounds were present, among which 12 representatives of the local industry and 9 members of Working Group 3.

- Open Workshop on Achievements in Systems of Systems Research and Innovation, on May 28th, 2015 in Florence, Italy - organized by the European Systems of Systems Research and Innovation Cluster

  On May 28th the European research community on Cyber Physical Systems and Systems of Systems met in Florence for the workshop on Systems of Systems Research and Innovation. Representatives from the current (AMADEOS, CPSoS, DYMASOS, LOCAL4GLOBAL) and previous (CyPHERS, COMPASS, DANSE) EU-funded research projects were present to the workshop along with representatives from the European Commission.

  The projects presented research results on **Systems of Systems Dynamics, Management and Control** and on **Models and Tools for Systems of Systems Engineering**. The workshop was also the occasion of sharing ideas on steps toward innovation in the domain with presentation of the running projects on their vision of exploitation and innovation strategy.

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The roadmap on **Core Research and Innovation Areas in Cyber-physical Systems of Systems** developed by CPSoS was presented to the audience and discussed bringing additional comments by the various project participants that complement the **public consultation**.

- CPSoS Working Groups Meeting and Open Workshop organised at the ARTEMIS Technology Congress 2015 on Oct 6, 2015 in Turin, Italy

  Medium-Term Research Priorities for Cyber-physical Systems of Systems: The third meeting of the three CPSoS Working Groups has taken place on October 6th, 2015 as an Open Workshop on the Cyber-physical Systems of Systems Roadmap at the ARTEMIS Technology Conference 2015 in Turin, Italy.

  This workshop was the occasion for presentations and discussions around a number of medium-term research priorities as defined within the "Cyber-physical Systems of Systems Research Agenda 2015-2025" which is currently being established by the CPSoS Project. Besides, domain-specific topics for different areas have been put forward

  Detailed information on the event is provided in Deliverable D3.1 Report on the third meeting of the Working Groups (joint meeting)

- A Networking session "Systems of Systems Engineering: What Next?" was organised by CPSoS at ICT 2015 in Lisbon (October 22, 2015).

  CPSoS held a networking session "Systems of Systems Engineering: What Next?" during the conference ICT 2015 (Innovate, Connect, Transform), the largest ICT event organized by the European Commission, with thousands of attendants expected. In addition to networking events and opportunities, ICT 2015 offered numerous events on new EC ICT policies and initiatives and funding opportunities, interactive exhibitions, and a start-up forum.

  The objective of the CPSoS networking session, which took place on October 22nd, starting at 14h50 in Room 10, was to discuss the "What next?" in systems of systems engineering from the point of view of industrial and academic reality, based on the CPSoS Roadmap. 45 participants attended the session which was good for the last slot on the last day of the conference

- Final CPSoS event on April 11th, 2016 at CPS Week 2016 in Vienna, Austria, and Public workshop of the European project CPSoS: "Cyber-physical Systems of Systems – The Next Challenge" on April 26th, 2016 at Hannover Messe 2016 in Hannover, Germany. CPSoS has organized two final events, to target different communities:
  - one, as part of CPS Week 2016, to disseminate results of the project work to the academic community. The program consisted of interesting presentations from both industry and academia that underpin the importance of the key research topics previously mentioned.
  - and another one, at Hannover Messe 2016 in Hannover, Germany, to target especially the industrial community.

  At these two events, the project team and the participants discussed about the way forward for the engineering and management of large-scale cyber-physical systems of systems, as well as research and innovation priorities for cyber-physical systems of systems that are proposed by the ARTEMIS Industry Association and by CPSoS (http://www.cpsos.eu/roadmap). The discussion in Hannover was also stimulated by presentations from leading representatives of the European industry that develop and deploy components of cyber-physical systems of systems.

  Detailed information on these two final project events will be provided in Deliverable D4.4 Report on final -events "Cyber-physical Systems of Systems Meeting Societal Challenges". There were about 70-80 participants at the events (the Hannover event was public meeting at the Hannover fair and thus a number of participants only attended one part of the event and were not registered).

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Project Booth:

- Exhibition Booth, joint with FP7 Project DYMASOS, on March 10-11, 2015 at ARTEMIS Co-Summit 2015 in Berlin, Germany

  The CPSoS project participated to the ARTEMIS Co-summit 2015 exhibition in Berlin with a joint booth with the DYMASOS project.

  The objective of the project participation to the event was to reach out to the ARTEMIS/ECSEL/ITEA communities and to increase project visibility in these communities. The event was also a good opportunity to launch and promote the project public consultation on the initial roadmap document.

  Through the two days meeting the CPSoS project connected with companies involved in ARTEMIS project (with a strong focus on innovative SMEs and system integrators), and initiated discussions on future research directions for Cyber Physical Systems of Systems.

Project Presentations during Relevant Events

The CPSoS partners represented the project at several opportunities, where the CPSoS was getting visibility in the related community that could be interested in the roadmap and possibly provide input and feedback.

- October 11, 2013: Third EIRICT Lunch Meeting on Cyber-Physical Systems, Eindhoven, Netherlands
- October 14-15, 2013, Munich, Germany - CyPhERS workshop
- October 29-30, 2013: Cyber-Physical Systems: Uplifting Europe's innovation capacity in Brussels, Belgium
- December 4, 2013: Panel Discussion PowerMEMS 2013 London, UK
- December 6, 2013: Workshop UK/Japan London Royal Society, London, UK
- May 23, 2014, in Porto, Portugal: Second Experts Workshop of the support action Road4FAME
- June 23, 2014, HYCON 2 Final Workshop at the European Control Conference
- August 26, 2014 - Panel discussion at the 2014 IFAC World Congress
- September 9-11, 2014: Automotive Megatrends, Brussels, Belgium
- September 23-24, 2014: Cyphers workshop in Stockholm, Sweden
- November 10-11, 2014: BIN Event, Sheffield, UK
- Conference Advanced Engineering UK 2014 November 11-12, 2014, Birmingham, UK; General Public – Europe
- Presentation at PowerMEMS school of PowerMEMS Conference November 17-18, 2014 Awaji Island, Japan; General public, scientific audience >1000
- December 16-17, 2014 - IoT Meeting Brussels, Belgium
- April 2015, in Madrid, Spain - Contribution of CPSoS topics to the Road4FAME business modelling workshop
- Road4Fame dissemination event in May 2015 – presentation on the CPSoS roadmap
- Presentation at EC Consultation: Digital Revolution in Europe: Converging Visions for a Smarter World, May 22, 2015 Brussels, Belgium (https://de.amiando.com/road4fame-consultation.html)
- Presentation and participation in a panel discussion at the ARTEMIS Summer Camp, June 10-11, Helsinki.
- Road2CPS roadmapping workshop, June 24, 2015, Paris, France
- Cranfield University - Industrial Advisory Meeting September 19, 2015 Cranfield, UK Industry; and Academia 20 UK
- Road2CPS – Workshop on Future Platforms, October 8, 2015 in Turin, Italy
- CEATEC 2015, Makuhari Messe, Tokyo, Japan; 7-10 October 2015 - International manufacturers and researchers 1000+ Global

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- Meeting Nikkei Business Publications October 10, 2015 Tokyo, Japan Business Press http://www.nikkeibp.com/adinfo/printmedia/ne.html
- Meeting Asahi October 10, 2015 Tokyo, Japan Industry 4 Global
- Presentation to OMRON Automation October 13, 2015 Kumamoto, Japan Industry 30 Global
- Participation in H2020 Info Day in Brussels, Belgium on Dec 1, 2015: The presentation of the CPSoS Roadmap was part of the introduction to a session on ICT-1-2016 Smart Cyber-Physical Systems.
- Speech on Ethical Aspects of CPS – European Parliament Jan 14, 2016
- Collaboration Workshop of the TAMS4CPS Project on Transatlantic Modelling and Simulation for Cyber-physical Systems (http://www.tams4cps.eu/) on February 11-12, 2016 - International Auditorium, Brussels, Belgium
- Oceanology Conference, (Surface and Underwater Autonomous Vehicles), London, UK, March 16-17, 2016
- Two presentations at ICT.Open 2016, on March 22, 2016 in Amersfoort, The Netherlands – organized by Netherlands Organisation for Scientific Research (NWO) and Technology Foundation STW under the auspices of ICT research Platform Netherlands (IPN)
- eMerge Americas Miami, USA, April 17-20, 2016 (Meetings with Governor Miami, Dutch Embassy, British Consulate, German Consulate). Presentation at Workshop on “Accelerating Smart Cities”: environment, safety, transport, utilities & buildings"
- Presentation at PICASSO EU-US Expert Group Meeting, Washington DC, USA, May 20, 2016
- Presentation at SAFETRANS Industrial Day, Berlin, Germany, June 3, 2016 (Panel “CPS: Research Challenges & Research Landscape”
- Presentation at CPS Consultation Event, Brussels, Belgium June 13-14, 2016

Presentations at large enterprises were also done, for example the following two presentations were organised by the CPSoS partner Haydn Consulting:

- Presentation to UK Transport Catapult – Transport Innovation Centre 18 September 2014 Sheffield, UK
- Outcomes presented at meeting with Rolls-Royce, Derby, 23/3/2016

A number of presentation was done at the events of ARTEMIS IA Association – see below, chapter “Networking with ARTEMIS IA”

Cooperation with / Support to the European Parliament

CPSoS partner Haydn Thompson supported the European Parliament at several occasions using the knowledge accumulated in CPSoS project, e.g. via

- Redaction of a briefing paper on Transport and Logistics for European Parliament
- Preparation of one page summary brief for MEPs (Members of European Parliament)
- Giving a short speech on the Future of Transport and Logistics, Social Issues, Barriers, etc. to MEPs, and Policy Staff in January 2016.
- Did piece to camera for video targeted at MEPs.

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Networking with SoS project cluster and relevant communities

European Systems of Systems Research and Innovation Cluster

The four EU projects on Systems of Systems – AMADEOS, CPSoS, DYMASOS and Local4Global – have joint forces as European Systems of Systems Research and Innovation Cluster and interacted in various ways.

Representatives of the projects AMADEOS, Local4Global and DYMASOS contributed to the three Working Groups set up by CPSoS. Mutual participation in workshops and events and specific cluster meetings, as well as further interactions were organised around synthesis reports and strategic policy documents.

A total of four joint newsletters was published during the lifetime of CPSoS, containing contributions from and about the projects in the cluster. (see chapter "Newsletters" above)

Networking with ARTEMIS IA and other relevant communities

Regular cooperation with the ARTEMIS Industry Association was realised, in particular via:

- Presentation of "Key Innovation and Research Challenges in Cyber-physical Systems of Systems" on June 10th, 2015, at the ARTEMIS Summer Camp 2015 in Helsinki, Finland
- Panel session on "Roadmap Challenges for CPS" on June 10, 2015 organised by ARTEMIS IA
- Presentation of CPSoS key challenges and DYMASOS results at the ARTEMIS Technology Conference, Torino, October 6, 2015.
- CPSoS public workshop in Florence, at the ARTEMIS Technology Conference, Torino, Italy, October 6, 2015
- Contribution to the ARTEMIS Strategic Research Agenda 2016 – Section on CPS
- Smart Cyber-Physical Systems Clustering Event, organised by the European Commission and the Road2CPS project as part of the ARTEMIS-IA Spring Event, April 13-14, 2016, and co-located with the international conference "CPS Week", April 11-14, 2016, in Vienna, Austria.

CPSoS further regularly interacted and exchanged information with external initiatives and other projects such as Road4FAME, Road2SoS, and TAMS4CPS (in which several CPSoS partners were involved), and the NoE HYCON2.
CPSoS also contributed to the strategic research agenda of IFAC, the International Federation of Automatic Control via membership in the task force.

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4. Sustainability and Impact

Activities to enlarge impact

Following the first project review recommendation, an internal project document about the impact channels was prepared and discussed by the CPSoS team. The document presented a high level vision of the project objectives and strategy in term of impact, defined some of the key targeted ecosystems relevant for the project impact, and finally, defined in more detail the actions planned to reach maximum impact.

To reach impact the dissemination of the project results in the relevant communities is essential. The project deals with a field of research that is of key importance for Europe's competitiveness and for the well-being of its citizen (as e.g. energy systems, transport systems, air traffic management, water and gas networks, production systems). However research in the area of Cyber Physical Systems of Systems is for now only emerging (with TRL rarely above 4), linked with different potential research areas (CPS, SoS, IoT, Systems and Control, application domains) and with different industrial communities. A challenge was therefore to reach out to these different communities, in order to both integrate their views in the analysis of the research roadmap and to disseminate the project findings to ensure the take up of the identified subjects by both research and industry.

The **targeted ecosystems** were identified that the CPSoS project had to relate to in order to achieve impact, together with the way of how they can benefit of the project results. The ecosystems included:

Public authorities:

The public authorities were an important target ecosystem for the CPSoS project because of their potential impacts on the development of Cyber Physical Systems of Systems research and innovation. This impact is twofold: one aspect (sometimes called supply-side innovation policies) are the research and innovation policies that public authorities put in place to support research and industry competitiveness on their territory (such as the H2020 programme or other national research agenda initiatives). The second aspect is the potential impact that public authorities can have on the demand for innovation solutions in the industry (demand-side innovation policies) through public procurement, tax incentives or regulations. In the case of Cyber Physical Systems of Systems these could be regulations and initiatives linked to transport systems, energy and environmental regulations.

Taking into account the nature of the CPSoS project, the actions targeting this community were predominantly on the European level, namely:

- A meeting was organised with the DG CONNECT (CPS Unit and IoT Unit) to present the project findings
- Contribution to the next Workprogramme was provided, based on the project findings
- Information about the European CPSoS Roadmap proposal was provided to the European ICT clusters, who are linked to the public authorities (public authorities are members of the clusters or/and funding agencies)
- Work with the European Parliament was done by a CPSoS partner, using the CPSoS findings

The findings and proposals of the CPSoS project influenced the Work Programme 2016-2017, in particular the CPS Call topic.

CPS ecosystem

One of the first and most natural communities of the project for interaction are the other European research projects targeting the same area of advanced computing, embedded and control systems (FP7) and cyber physical systems (H2020). These interactions were important because they:

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- Strongly contributed to the project understanding and analysis of the state of the art in CPSoS research and need for further developments (contributing to the research roadmap).
- Benefited from the project vision on the research roadmap and from increased communication on CPSoS research opportunities.
- By involving key players from both research and industry, they were a channel for transmitting the outputs of the CPSoS project to the members of their consortium.

The CPSoS project directly involved representatives from the following running SoS STREP/IP FP7 projects:

- AMADEOS Architecture for Multi-criticality Agile Dependable Evolutionary Open System-of-Systems
- COMPASS Comprehensive Modelling for Advanced Systems of Systems
- CyPhERS Cyber-Physical European Roadmap and Strategy
- DYMASOS Dynamic Management of Physically Coupled Systems of Systems
- Local4Global System-of-Systems that act LOCALly For optimizing GLOBALly

The CPSoS project linked with other H2020 projects that started in 2015 – such as Unify IoT and PICASSO - (starting in 2015) to ensure they start with having the initial results of the CPSoS project available.

ARTEMISIA / ECSEL

ARTEMISIA Industry Association is the association for actors in Embedded & Cyber-Physical Systems within Europe. It is a membership organisation with more than 180 members and associates from all over Europe. As private partner, the association represents its members - industry, SMEs, universities and research institutes - in ECSEL Joint Undertaking.

The ECSEL-Joint Undertaking (JU) programme started with the merge of the previous ARTEMIS-JU and the ENIAC-JU in June 2014 and will finish in 2024. Three industry associations (including ARTEMIS Industry Association) represent actors from the areas of Micro-/Nanoelectronics, Embedded and Cyber-Physical Systems and Smart Systems. It has an estimated budget of 4.815 billion Euros, half from public fund (EU and participating member states) and half from industrial partners. It targets 5 key application domain topics and 4 essential capabilities.

ARTEMISIA ecosystem was an important target for the result of the CPSoS project, and many interactions were done in this direction, both ways (e.g. participation in the public consultation, organisation of joint events, etc.). This led to results of CPSoS project being integrated in the roadmap of the ARTEMIS IA.

Industrials and SMEs

The direct interaction with major industry leaders and innovative SME was an essential part of the CPSoS workplan. This is reflected in the composition of the project working groups, but also completed by external interactions. This ecosystem was targeted via the project events – at the ARTEMIS Co-Summit, EU ICT 2015, ARTEMIS Summer Camp and Technology Days, Hannover Fair and by mailings to European clusters etc.

Specific communities, such as IoT community

The Internet of Things concept that originated from the network and telecommunication community is strongly related to the Cyber Physical Systems of Systems concept, although with a different focus. The two areas share common research topics while others are clearly specific. The IoT and CPS community are both evolving toward each other and more and more connection will exist in the near future (ICT30 call). They can both benefit from interactions. The IoT community in the research domain is represented by the IERC (Internet of Things European Research Cluster) and the AIOTI (Alliance for Internet of Things Innovation, launched in March 2015). The CPSoS

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project related to the IoT community via exchanges with the PICASSO project, UNIFY IoT project and other networks (including LinkedIn group on IoT).

Application domains

CPSoS proposals can be expected to have a strong impact on many essential aspects of our modern lives, and to impact many industries. The interactions with these application domains were thus important for the impact of the CPSoS project by providing insight on the needed research topics for the research agenda, and opportunities for take up of the research agenda by industrials and researchers in the application domains.

The exchanges were pursued especially with the transportation and logistics community, energy sector, the process industry and manufacturing, as well as , at some extent, with the software industry – via exchanges with other projects (such as ROAD4FAME), and with thematic clusters (such as SAFETRANS) etc.

In all cases of these targeted ecosystems, the strategy to enlarge the project impact was the following:

- To provide information on the CPSoS activities
- To involve them in the CPSoS activities, such as public consultation etc.
- To participate in the events organised by those ecosystems (especially ARTEMIS IA, SAFETRANS, NAMUR and others)

The CPSoS presented the project findings to the ARTEMIS community and as a consequence, CPSoS was invited to contribute to the ARTEMIS SRA as the topic of Cyber-physical Systems of Systems was considered to be an important challenge in the future.

Impact summary

Europe is a world leader of ICT technologies, many of them being crucial for the development of technologies needed in the engineering and management of cyber-physical systems of systems. This is evidenced by the European origin of many global market players in areas such as business management applications, cyber security, computing, telecommunications, automation, intelligent building technologies, e-commerce solutions, cloud-based management software products, etc. The position of Europe as a technological innovator and an incubator of successful ICT business models is, however, not secured when taking into account demographic changes and established and emerging markets in Asia, America, or Africa. Europe should build upon its successful technological developments and provide opportunities for CPSoS innovations that are necessary and vital for transportation, the process and manufacturing industries, the energy sector, and smart building technologies. This way, new jobs are created, and a competitive economy is expanded, which is a prerequisite for sustainable growth.

Europe needs to capitalize on its expertise, and the successful exploitation of ICT in cyber-physical systems of systems generates opportunities to provide efficient, environmentally friendly, autonomous, and safe mobility; greater efficiency in management and operations for the process industries, manufacturing, power plants, energy conversion, smart grids and smart metering; and greater benefits to citizens via smart, safe, and secure cities, energy-efficient buildings, and green infrastructure (traffic management, lighting, water and waste management).

The significant long-term impact that the CPSoS project has already had and will have in the future results mainly from its hybrid bottom-up and top-down approach, in which the CPSoS project has analyzed the challenges, needs, and commonalities of a variety of industrial and infrastructure sectors (transportation, logistics, energy, production, and smart buildings) and has placed them in relation to existing methodologies and tools for complex systems engineering. A solid foundation was developed for researchers, practitioners, and policy makers to understand practical and theoretical needs and challenges, and how novel CPSoS engineering and management technologies are essential for the realization of the next generation of smart, globally networked, and highly integrated industrial systems and infrastructures.

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In cooperation with hundreds of renowned researchers and practitioners from a variety of sectors, the CPSoS project has developed two major strategic documents. The first is a comprehensive report that summarizes the state of the art regarding cyber-physical systems of systems and related technologies in a variety of technology and application sectors and that identifies commonalities. A key feature of this report is that while systems of systems are so far mostly considered at a higher, abstract level, the report relates the concepts of systems of systems to concrete complex technical systems from the European industry, and to large infrastructure systems, thus providing evidence of concrete gains that can be achieved when systems-of-systems and CPSoS technologies are developed and deployed. The value of this focus on concrete industrial and infrastructure systems was attested to by the very positive feedback that this approach has received on numerous occasions at which we presented the CPSoS results to industrial and academic audiences. The state-of-the-art report has been distributed widely throughout the project duration, and we believe that it will be a valuable reference for decision makers, researchers, and innovators also after the project.

The second strategic document**, the "Proposal of a European Research and Innovation Agenda on Cyber-physical Systems 2016-2025",** identifies core research and innovation challenges and the most pressing medium-term research and innovation priorities in the area of cyber-physical systems of systems, including both technology and societal aspects. The development of the proposal started already in the first months of the project, and over the years, more than hundred experts have contributed content, have provided feedback, and have ensured that the challenges and priorities reflect the actual needs of European industry and the current state of the art in theory, methods, and tools. We believe that the challenges and priorities in the proposal will help to substantially reinforce Europe's scientific excellence and technological leadership in the topic, and to strengthen Europe's competitiveness on a global level.

The CPSoS consortium has used the proposal, in all iterations from first conception to the final high-quality brochure, to influence industry, research, policy makers, technology platforms, and strategic roadmapping efforts. In December 2014, an initial version of the proposal was presented to and discussed with representatives of the EC and has influenced the draft of the H2020 Work Programme for the years 2016-2017. The challenges and priorities were introduced to technology platforms such as IFAC and ARTEMIS IA, both of which have adopted the area of the engineering and management of cyber-physical systems of systems as a strategic research challenge in their Strategic Research Agendas. In addition, the challenges and priorities were used on numerous occasions to cross-fertilize strategic, research, and innovation efforts, such as the EU projects Road2CPS, CyPhERS, Road4FAME, and TAMS4CPS.

The new support action PICASSO (ICT Policy, Research and Innovation for a Smart Society: Towards new Avenues in EU-US ICT Collaboration, www.picasso-project.eu), in which most of the CPSoS partners are involved, is influenced by the results of the CPSoS project. Starting from the CPSoS challenges and priorities, the PICASSO Expert Group on the Internet of Things / Cyber-physical Systems (IoT/CPS), which is chaired by the CPSoS coordinator, will identify the key societal challenges, analyze technology strengths in the EU and the US, and make proposals for future EU-US collaborations in the intersection of IoT and CPSoS, where the connectivity provided by the IoT is seen as an enabling technology for future CPSoS to enable improved monitoring and management.

To maximize its impact, the proposed research agenda has been widely distributed to a variety of audiences, in electronic form via social media channels, such as LinkedIn and Twitter, via mailing lists of different expert networks, and via advertisements in presentations by the CPSoS consortium. In addition, several hundred hard copies have so far been distributed at public events, such as the CPSoS workshop at Hannovermesse 2016 and the First PICASSO EU-US Expert Group Meeting in Washington, D.C., the General Assembly of the European Control Association and at conferences and symposia. We have used a variety of channels to inform relevant EU companies and institutions of the potential of CPSoS engineering for their future products and solutions, and to help prepare EU stakeholders in the targeted application areas for extracting competitive advantages from CPSoS developments.

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We have noticed a high degree of interest in the proposal from all of the targeted audiences (practitioners, researchers, decision makers, initiatives, ...) and received a lot of positive feedback, and the consortium plans to continue disseminating the CPSoS project results to suitable audiences using the CPSoS proposal brochure after the project has ended.

The area of complex systems and CPSoS engineering is inherently inter-disciplinary, and the CPSoS project has successfully built a CPSoS constituency with key researchers and practitioners from a wide variety of sectors. This network includes the three CPSoS Working Groups with 36 representatives from key industrial sectors and research experts, and interested external practitioners and researchers. In several public events and in the joint meetings of the SoS cluster projects that were organized by CPSoS, we have brought together specialists from different application and technology domains to favor cross-fertilization among different sectors.

Based on these successes, we believe that the CPSoS project has achieved significant impact in various areas and that it has provided a sound basis for lasting and sustainable positive impacts also after the project end.

To ensure the sustainability of the CPSoS materials and additionally enlarge impact, the CPSoS web site will remain open for the 2 more years after the project end, and will be maintained by inno TSD.

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